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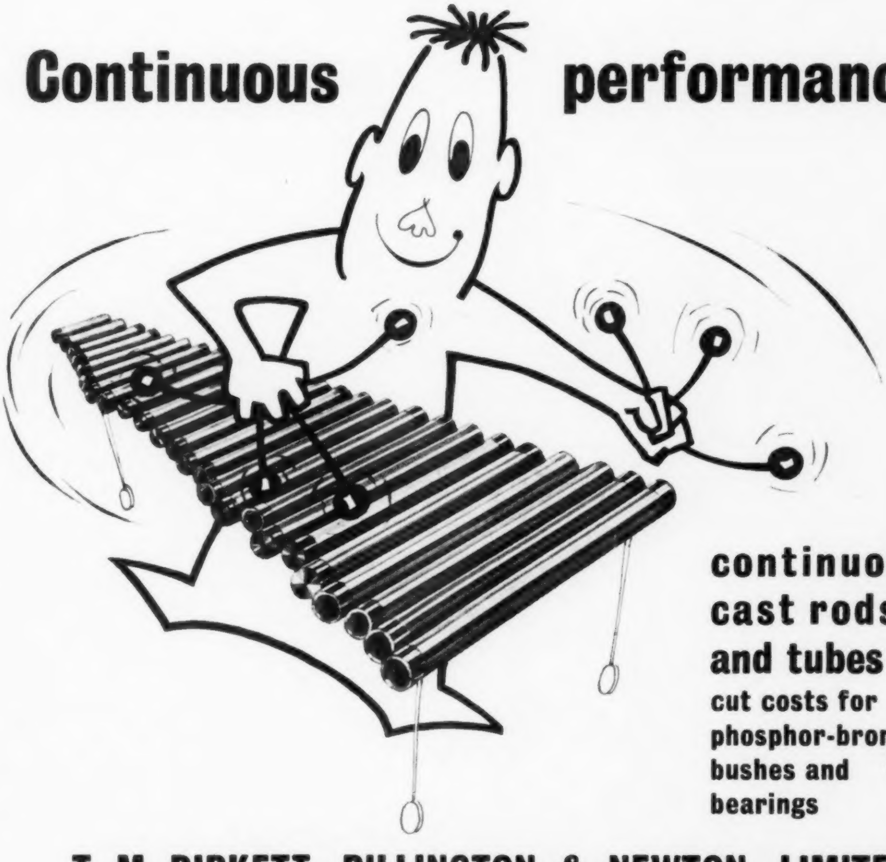

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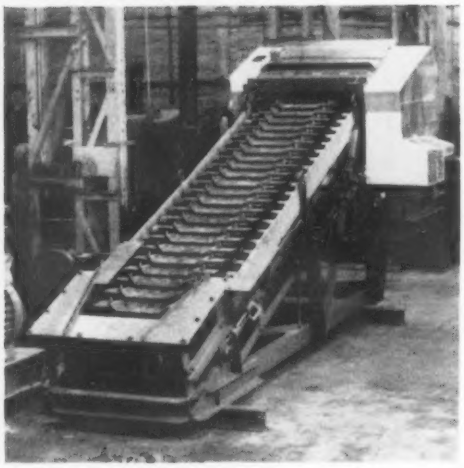

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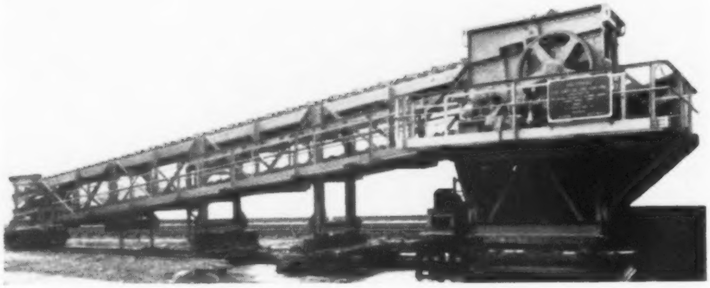

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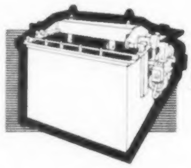

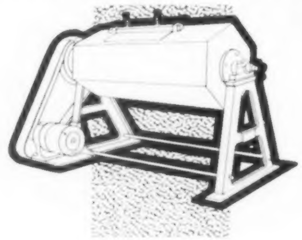

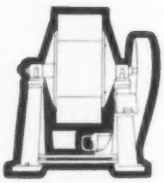

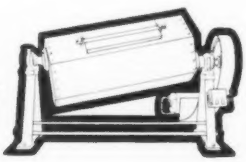

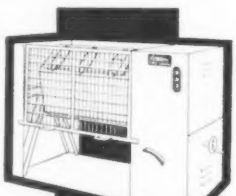

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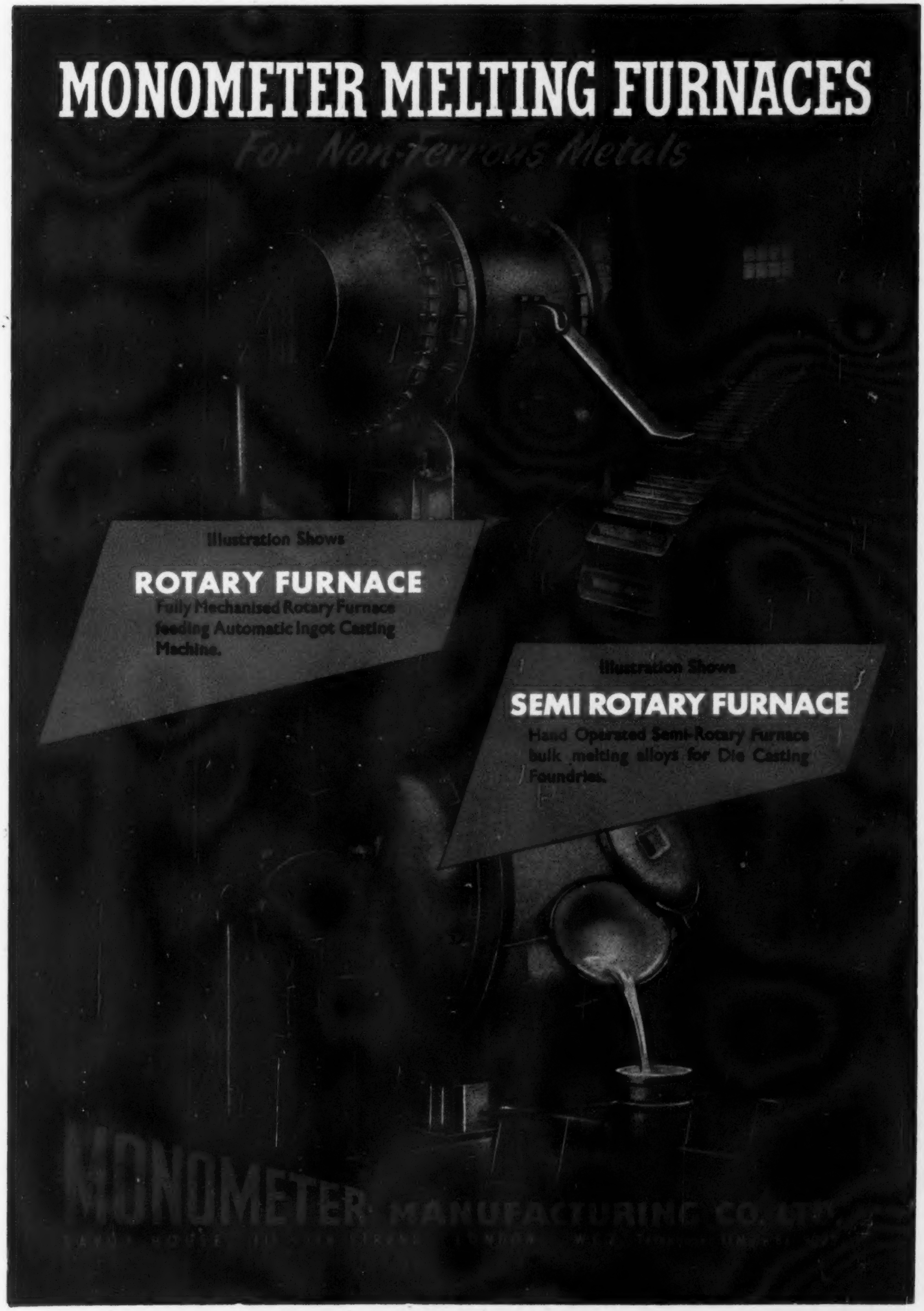

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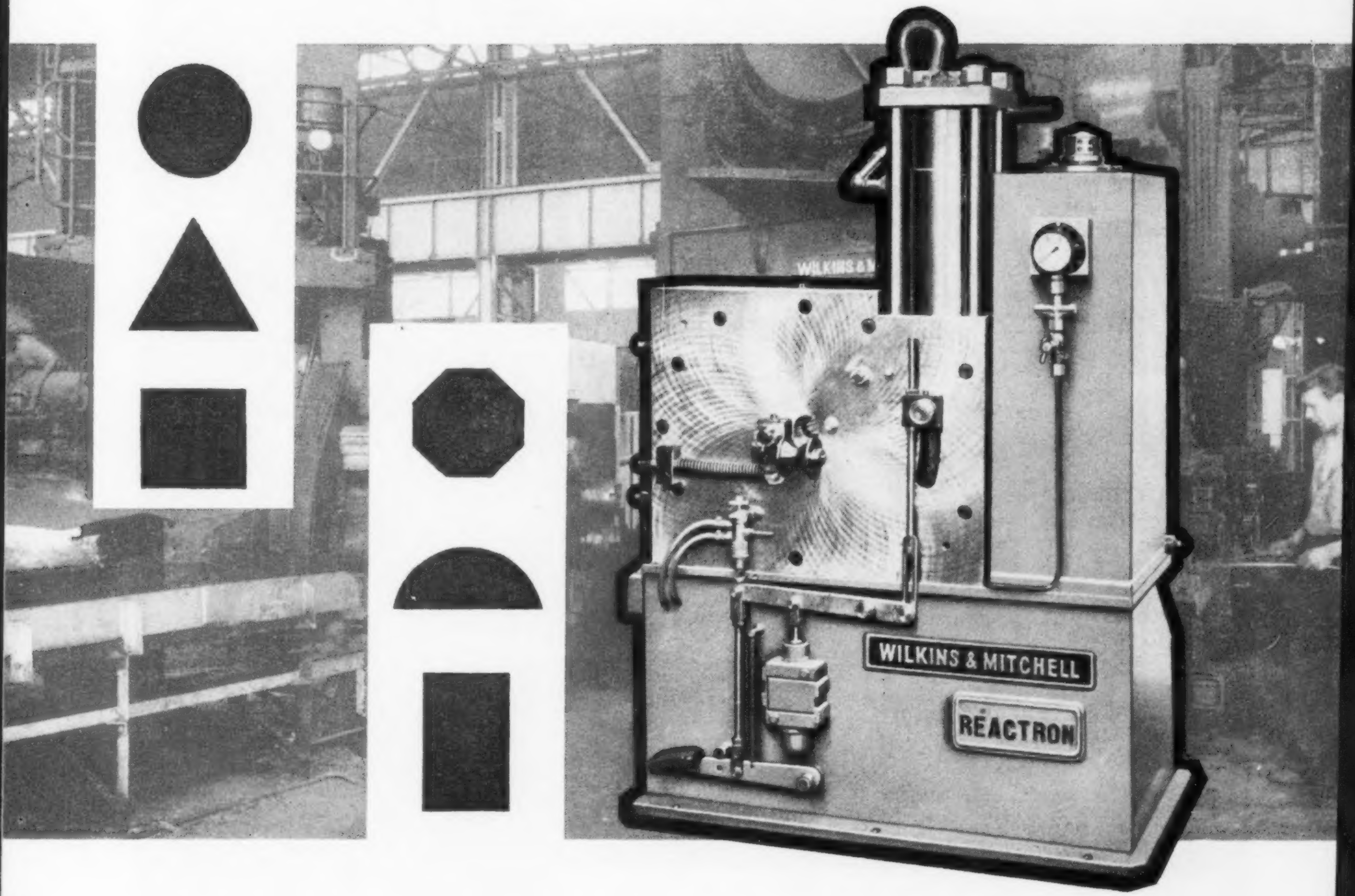

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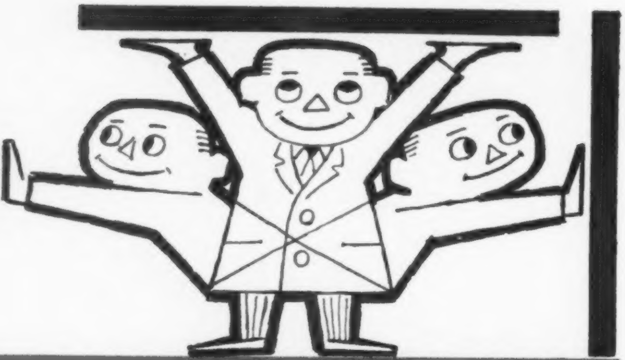

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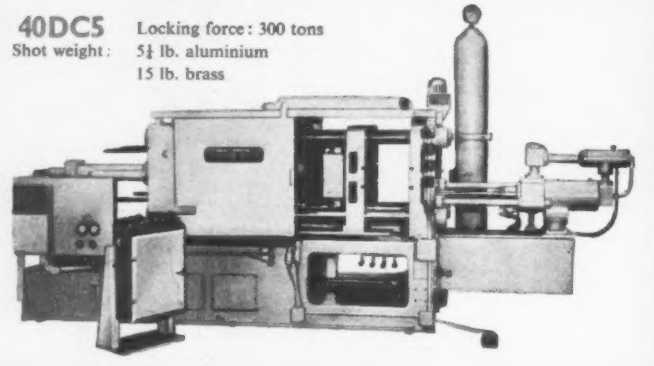

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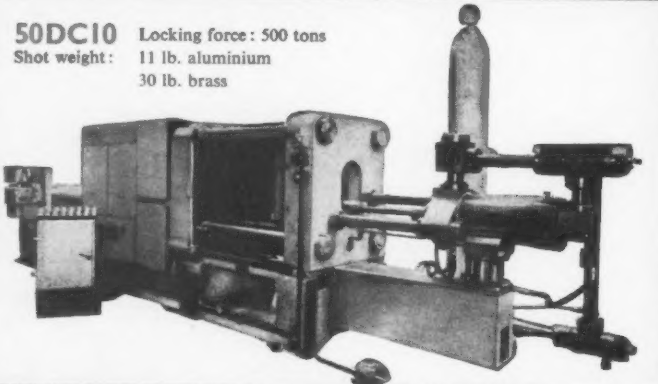

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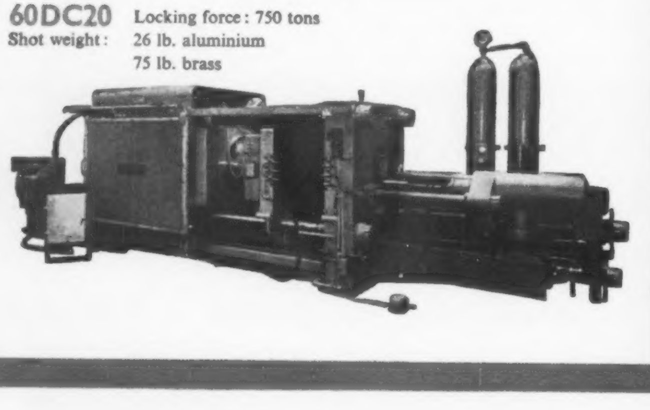

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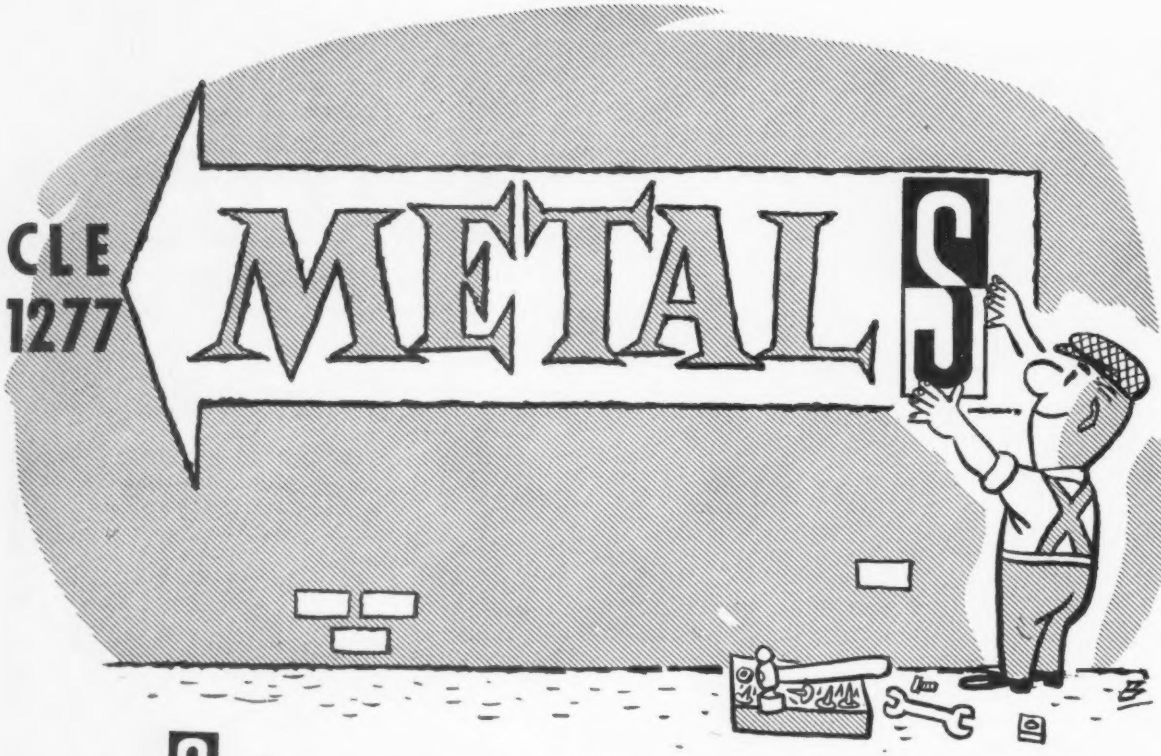

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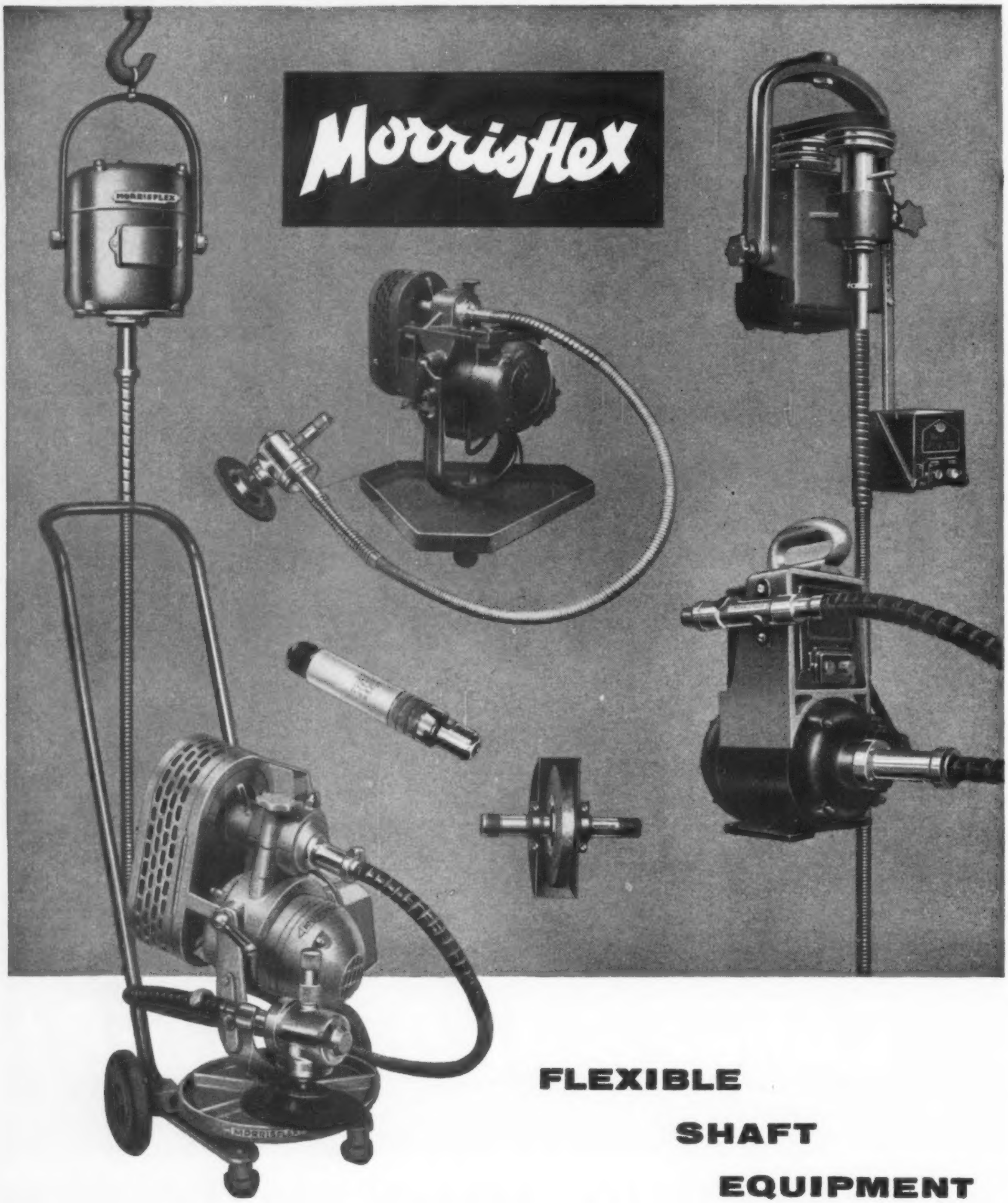

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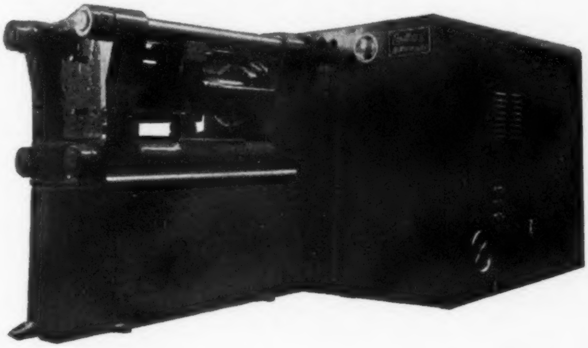

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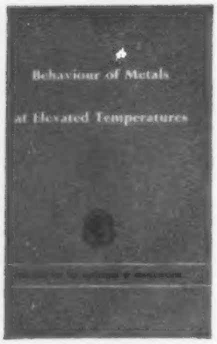

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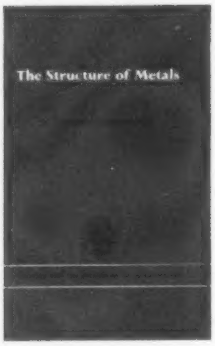

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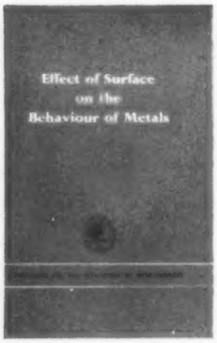

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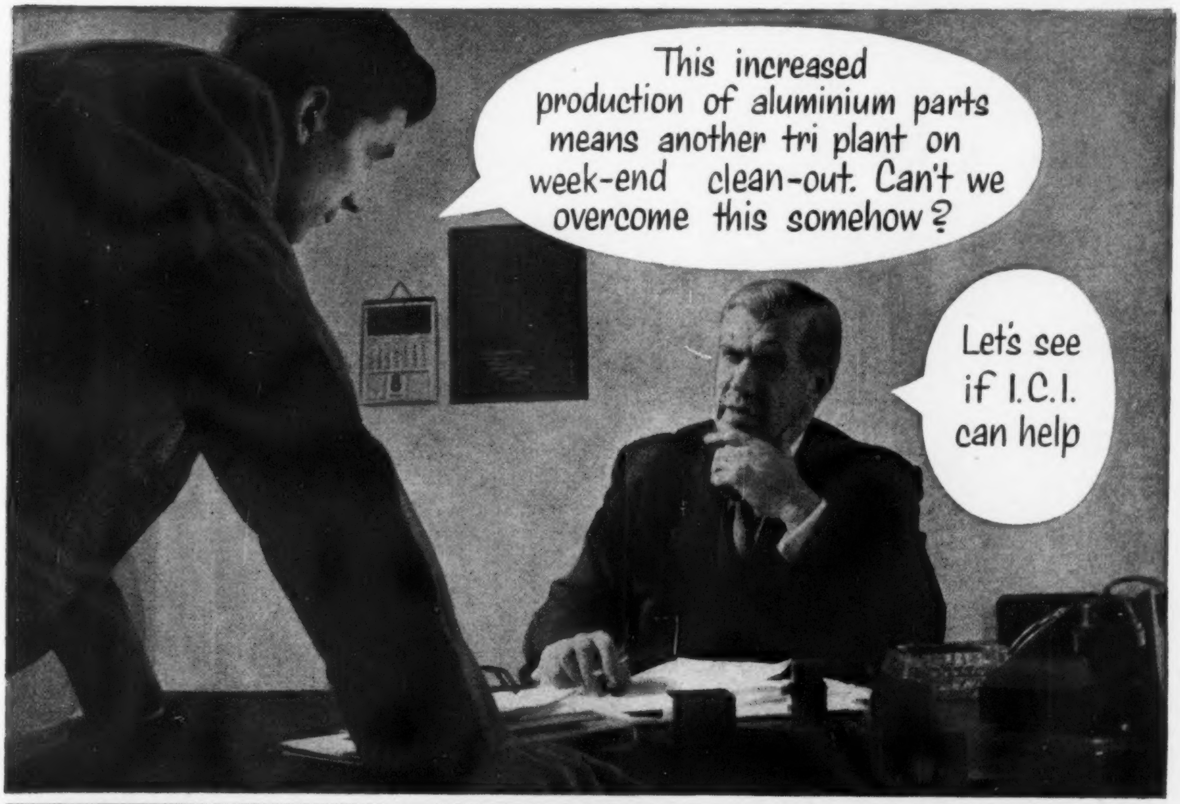

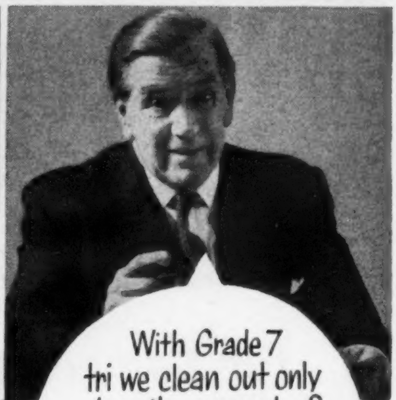

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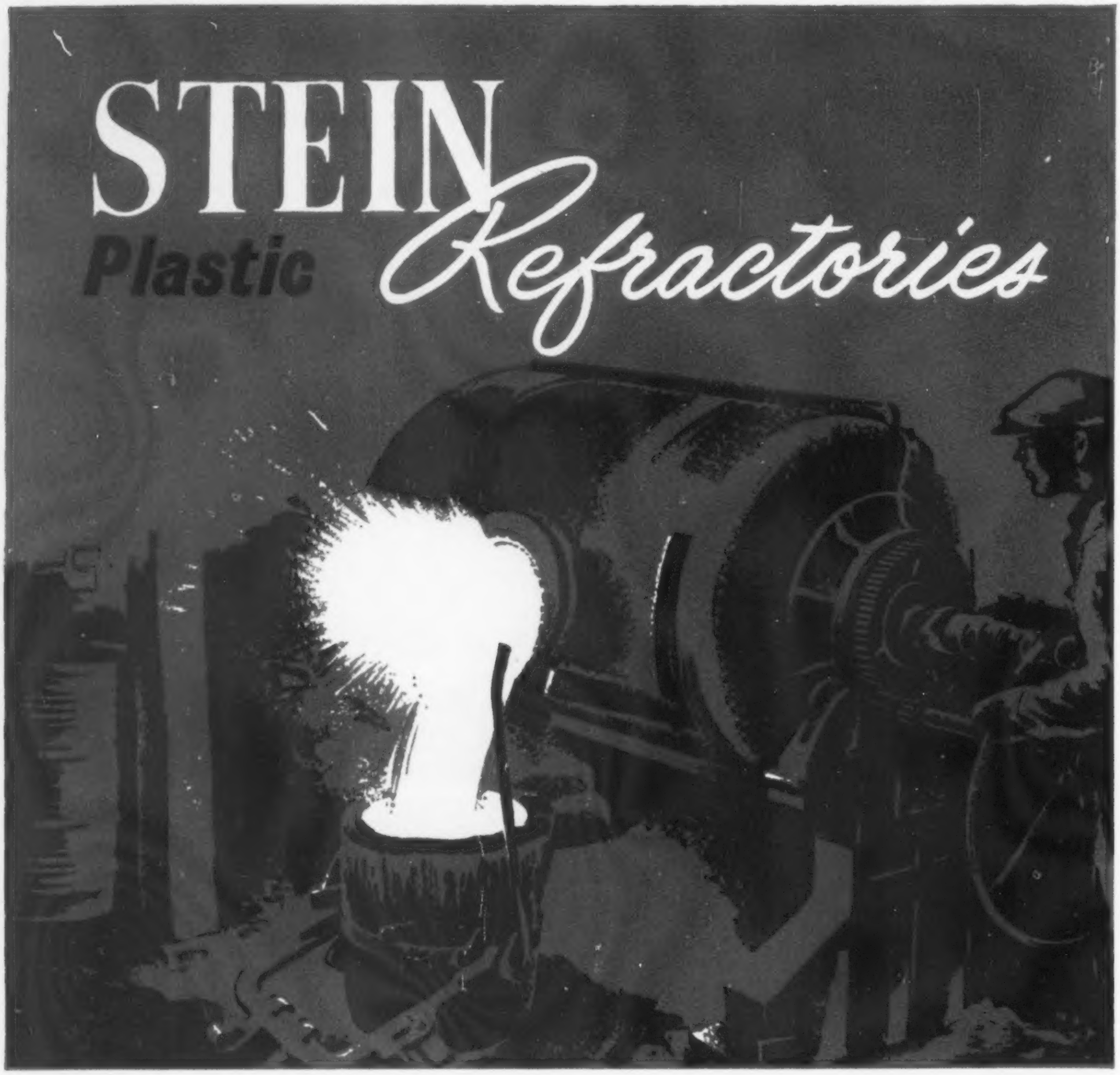

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27 JANUARY 1961 VOLUME 98 NUMBER 4

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Nickel and Chromium Recovery

SYSTEMATIC study of the problem of industrial effluents offers the possibilities of reclamation of valuable materials, reduction of demand for rinse water, and simplification of the problem of disposal. For this reason a report of an enquiry into the losses of nickel and chromium during electroplating, recently issued by the Department of Scientific and Industrial Research, has much wider implications than its title, "A Survey of Nickel and Chromium Recovery in the Electroplating Industry", would suggest. Similar surveys on the effluent problems of other industries could, no doubt, be profitably undertaken.

Wastage of nickel and chromium salts in the electroplating industry is not only substantial but often causes a pollution problem to both the electroplater and the drainage authority. The greatest proportion of this loss is by "drag-out", though spray formation is a contributory factor. Out of an estimated 2,870 tons of nickel (to the value of £2½ million) used by the plating industry in 1958, about 290 tons represented the metal content of the nickel sulphate and chloride used—these chemicals costing about £300,000. These added salts thereby increase the total material cost by about 13 per cent. "Drag-out" losses account for at least 60 per cent of the expenditure on nickel salts. It follows that if "drag-out" is prevented from entering the running rinse system, and if it can be used as make-up in the plating bath, there will be a reduction of expenditure on new nickel salts. The installation of a simple static rinse tank, immediately following the plating bath, is all that is necessary to achieve this end, and has been found to eliminate three-quarters of the cost of these added salts.

Further, since most plating solutions are of the "bright nickel" type, "brighteners", which, in general, add anything between 8 and 20 per cent to the cost of nickel salts, will also be recovered although, even when "drag-out" recovery is practised, consumption remains relatively high. Savings are also effected in the volume of rinse water required and, where effluent treatment is practised, in the cost of chemicals used in the effluent treatment plant. Thus, it is estimated that in a plant incorporating effluent treatment and using 8,000 lb. of nickel anodes per annum, with water at 1s. 6d. per 1,000 gal., a total saving of £550 per annum would be achieved. Since for manually operated shops the cost of installing a "drag-out" tank, with pump for transferring the "drag-out" solution to the plating vat, should not exceed, say, £250, and the one extra rinse would not add materially to labour charges, the moral is obvious.

It is not such a simple matter to incorporate "drag-out" recovery in an automatic plant unless provided for in the design, because there is generally no possibility of installing an additional tank in the sequence immediately following the nickel plating vat. The only practical way of modifying an existing plant seems to be by using the first running rinse as a collector of "drag-out". Solution drawn continuously from the tank would, if necessary, be taken to an evaporator to raise the concentration to make it suitable for use as make-up. The most important factor in ensuring success of this method is accurate water control, because any excess water will be reflected at once in the cost of evaporation.

Attention is also drawn in the survey to the use of the ion-exchange process. At present handicapped by the initial cost of equipment and lack of operating experience, this process is a promising alternative to present treatment of effluent solutions by chemical means, which reduces impurities to a valueless sludge.

Out of the MELTING POT

Fatiguing Whiskers

SOME information on the behaviour of metal whiskers under fatigue stresses has been added by E. Eisner, of the Safety in Mines Research Establishment, Sheffield, to the existing knowledge of the mechanical behaviour of whiskers under static conditions and has also contributed a little evidence regarding the fatigue behaviour of metals in general. Under static conditions, copper whiskers, which were used for the fatigue tests, remained elastic in cantilever bending at static strains up to 4 per cent, corresponding to a stress of 470 kg/mm^2. When plastic deformation occurred, it was by "kinking", the "kink" being a bend having a radius of curvature of the order of the thickness of the whisker. It is formed suddenly, with release of elastic strain in the rest of the whisker. The fatigue tests on whiskers grown by hydrogen reduction of cuprous iodide were carried out in cantilever bending. The whisker was first bent to a strain which it could sustain without kinking, unloaded to check that no plastic deformation had occurred, and then subjected to 10^6 cycles (at 900 c/s) of strain varying between zero and the static strain initially applied. The initially applied strain was then increased by a small amount, and the fatigue test continued as above, with the strain varying between zero and the new, increased value of the strain. It was found that whiskers were generally capable of surviving such tests, apparently unaffected, to strains of the order of 3 per cent, with 10^6 strain cycles at each value of strain amplitude. "Failure" then occurred in the next cycle of fatigue straining at a slightly increased strain, the whisker suddenly kinking. As in static tests, the strains at which whiskers kinked in the fatigue tests were not very reproducible. Further fatigue straining of a kinked whisker resulted in fracture at the kink. In fatigue tests in which the strain varied symmetrically about zero, fracture did occur, probably preceded by kinking, though this was not easily detectable. There is thus no evidence of fatigue fracture in elastic whiskers, a conclusion which serves to confirm the belief that, in fatigue in general, slip is an essential process in failure.

More Money

A CLEAR appreciation of the existing and probable future situation in which more and more money is being spent on research of all kinds is rendered difficult by the simultaneous operation of several factors. There is the realization that expenditure on research is profitable in the long run. Research expenditure may also be increased, or in some cases initiated, by the very natural desire to keep up with some competitive industrial Joneses. Finally, there is, of course, the very large factor reflecting the growing number of new subjects demanding further research and expenditure. In addition to all these, to some extent extraneous factors, which operate to increase expenditure on research, there is also the factor connected with the inherent tendency of research to become more and more expensive. The inadequate and insufficiently detailed information regarding expenditure on research is not susceptible of being analysed to determine the magnitude of this factor and its variation with time. The still more uncertain information available on the returns from investment in research provide no indication as to whether the operation of this factor has any unfavourable effect upon them. Nevertheless, its incidence as such is sufficiently familiar, being reflected both by the increasing first cost of instruments, apparatus, etc., required for research, and the cost of using them. During the first flush of success, a few years ago, of the physico-mathematical approach to information as a change in entropy, the theory was extended to show that the factor we have just been considering is a consequence of the inverse relation between the magnitude of an effect and the difficulty of obtaining information about it. Hence the gigantic size of the equipment required to study the behaviour of subatomic particles and the size of optical and radiotelescopes necessary to detect the minute amounts of radiation reaching us from far distant galaxies. As this factor becomes more and more important, expenditure on research will become more and more a matter not of choice but of necessity, though, of course, there will always remain the choice as to whether we can really afford the necessity.

More Uncertain

THE strength of thin polycrystalline metal films obtained by vacuum deposition has, in the past, been studied by a centrifugal method and found to increase considerably as the thickness of the films was decreased below 2,500Å. There was also an indication of an increase in the elastic modulus as the thickness was reduced. These changes were ascribed to the effect of diminished grain size in the thinner films. While this explanation may yet apply to polycrystalline films, the probability of its being the correct one, and certainly of its being the only one, has been reduced by recent experiments on the mechanical properties of single-crystal gold films. Such films, for which the grain size effect explanation is, of course, inapplicable, were found to exhibit similar changes in properties as those previously observed in polycrystalline films. The neat experimental technique used is worth noting. The single-crystal gold films were formed by vacuum deposition on the cleaved (100) surface of sodium chloride supports measuring approximately 10 mm. square and 2 mm. thick. The temperature of the support had to be controlled between 370°C. and 380°C. to ensure the formation of a single-crystal film. Samples were prepared for testing by drilling a small hole through the sodium chloride substrate with a water jet to obtain an unsupported circular area of film approximately 0·5 mm. in diameter. The unsupported film wrinkled as soon as the substrate had been dissolved away because of the compressive stress in the film caused by differential contraction on cooling from the deposition temperature at which the film was under tension. The unsupported film was stressed by reducing the pressure below the film, thus bulging the film downwards. The stress was determined from the pressure difference (measured by a calibrated water manometer) and the strain (radius of curvature) by an interference method, the tests being carried out with the specimen under a microscope. The films underwent considerable plastic deformation, which was accompanied by the appearance and growth of mechanical twin bands. Both the ultimate tensile strength and the elastic modulus were found to increase as the thickness of the films was reduced (from 3,000Å to 1,000Å). No theoretical explanation for this increase has yet been offered.

Skinner

Electroshaping

ELECTROLYTIC PROCESS FOR RAPID FORMING OF HARD AND DIFFICULT MATERIALS

Waspalloy 11½ in × 4 in. chord turbine blades before and after electroshaping. That on the left is in "as-forged" condition; the blade on the right has been electroshaped

POTENTIALLY capable of duplicating all the common metal-shaping operations in use today, the electroshaping process developed by Steel Improvement and Forge Company, for which the United Kingdom rights are held by Metachemical Processes Ltd., promises designers much wider latitude in the choice of metal shapes which can be made economically.

A typical application of this process, Fig. 1, shows how the metal workpiece to be shaped is held in a specially-designed fixture. Electrodes which duplicate the final contours desired for the workpiece are positioned on each side of it and at an appropriate distance. Solution is continuously made to flow between the workpiece, which is made the anode, and the electrodes, which serve as the cathodes in the electrolytic circuit. As the electrolytic operation progresses, the electrodes are progressively moved closer together so that the metal workpiece is gradually "worked in" to its final configuration.

The process is particularly suitable for difficult-to-machine metals like tungsten, molybdenum and the super-alloys, as well as to the extremely hard materials like cemented carbides.

With the type of tooling shown in Fig. 1, the process is being applied on a production basis to form the aerofoil sections of jet engine turbine parts.

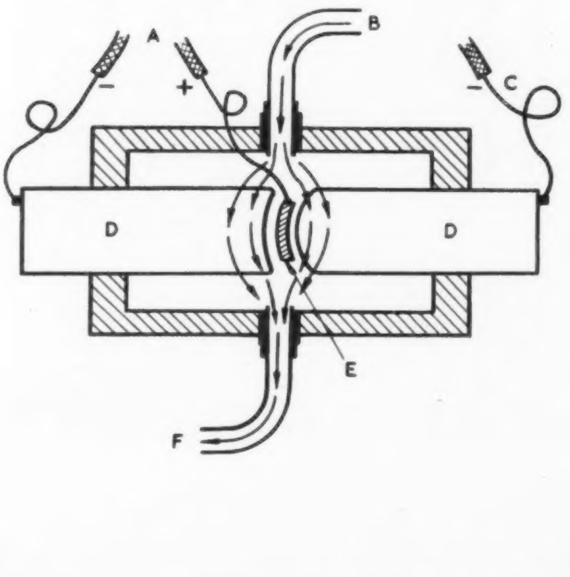
A more conventional operation, forming a surface of revolution, is illustrated in Fig. 2.

All the operations performed by electroshaping are essentially finishing operations — with no need for preliminary roughing. In contrast to other processes, the best finishes and the best dimensional accuracies are obtained at the highest metal removal rates.

Internal shaping, the electrolytic counterpart of internal grinding or turning, can also be carried out. Workpieces such as a rocket nozzle or a carbide drawing die can be profiled. A carbide die might be shaped to approximate rough oversize dimensions by the usual powder metallurgy techniques, then finish-contoured by electroshaping.

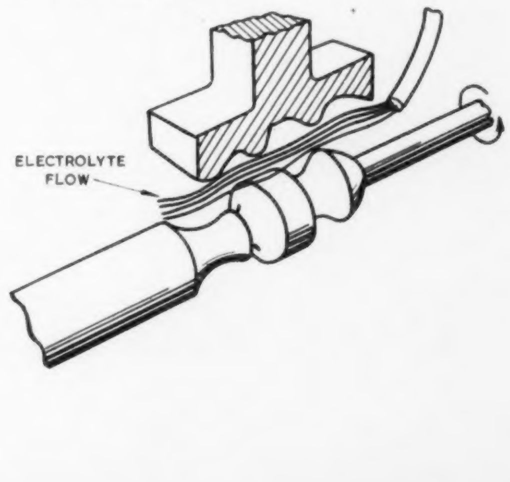
A type of operation similar in effect to milling or grinding can be used to obtain accurate surfaces, slots or grooves. This is particularly advantageous in providing dimensional accuracy over long lengths, such as are used for machine tool ways. The lack of tool wear or distortion of the work

A—To rectifier. B—Electrolyte from pump. C—To rectifier. D—Tool (cathode). E—Workpiece (anode). F—Electrolyte to reservoir.



Left: Fig. 1—Diagrammatic arrangement of electrodes and workpiece for electroshaping. Flow of electrolyte is indicated by arrows

Below: Fig. 2—For the production of a surface of revolution, similar to that of a turned part an arrangement similar to that shown here is adopted



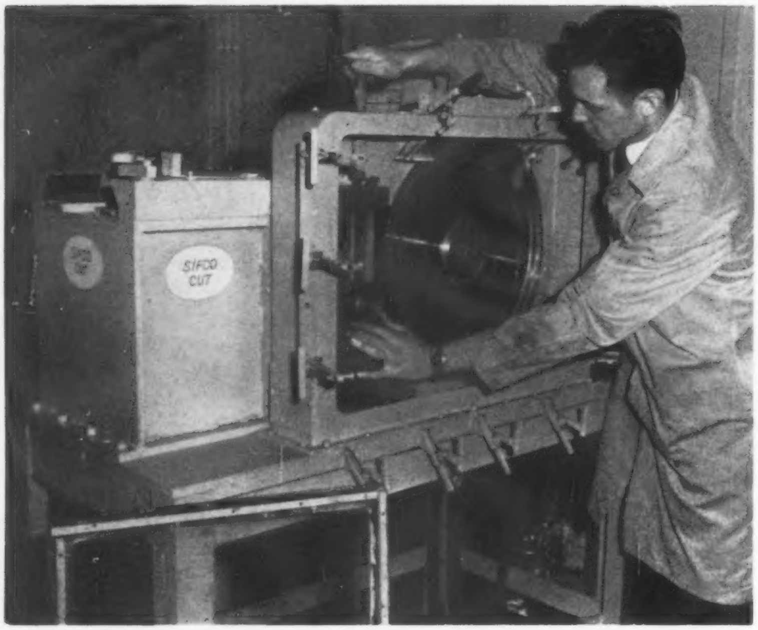


Fig. 3—Tungsten rod is clamped in "Sifco-Cut" machine preparatory to high speed cut-off operation. During operation, the large stainless steel electrode wheel rotates rapidly to direct—by centrifugal force—a volume flow of chemical solution between wheel and workpiece. An electric current, passed from workpiece to electrode wheel through a chemical solution, does the precision cutting. The stainless wheel is very thin, producing an equally thin cut through the workpiece

by heat are both important considerations.

An electrolytic cut-off application is shown in Fig. 3. This operation is similar to abrasive cut-off or circular sawing as applied to large billets (5 to 20 in. and over). Fully-hardened steels can be cut without surface damage or overheating. The unique feature of this method is the practicability of using a number of cut-off wheels on a single arbor. A billet can be cut into a number of pieces in one pass. By using thin cutting discs, considerable savings in expensive metals can be realized.

The electrolytic broaching of internal helical splines is shown in Fig. 4. The electrolytic cut-off operation of Fig. 3 can be used to slice off internal helical gears from one long section.

The drilling of deep holes is a fairly simple operation, and a rig for drilling an extremely fine hole 0·012 in. diameter is shown in Fig. 5. The hole can be round, square, fluted or of other complex shape.

A multiple hole drilling technique might be used to make the tube sheets for heat exchangers.

A special case of drilling a large hole and retaining intact the core (trepanning) is shown in Fig. 6. For expensive metals or alloys, the saving here can be extremely important.

In die-sinking operations, fairly complex forging dies can be produced. The blade die in Fig. 7 represents one of the latest developments of this technique. The chief advantage of this procedure is obtained where a number of dies of the same pattern are required. One tool, or electrode, can be used to produce any desired number of die impressions, each exactly like the others, and with many times fewer man-hours than would be possible with conventional die-sinking methods.

Metal Removal

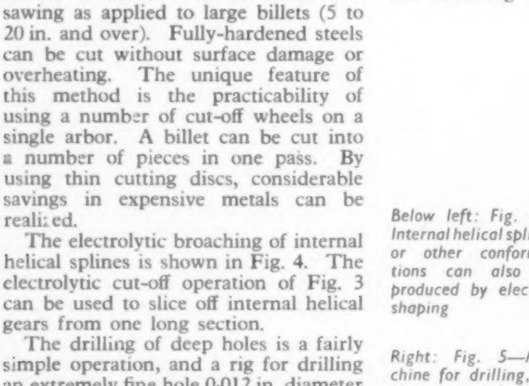
The speed of metal removal from a metal surface during electroshaping increases directly with an increase in direct current passed per unit of area. This rule applies as long as the solution can supply the reactants to dissolve the metal at the rate it is being electrolytically dislodged. The maximum speed of electroshaping is reached when the amount of electric current is so great as completely to deplete the reactants and/or to saturate the solution.

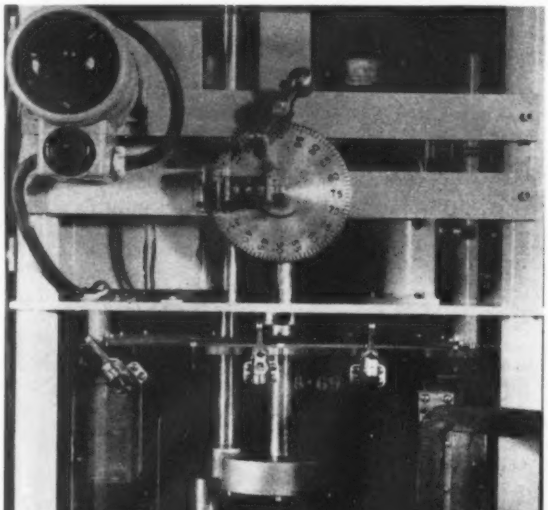
By the use of fixture designs that exchange the used chemical solution rapidly enough to support an electric current flow of up to 1,500 amp/in^2, 200 to 500 being most generally used, metal removal can be achieved at rates of 0·05 to 0·1 in/min.

The upper limit of rate of metal removal now is set by the maximum amperes that can be conducted into the

Below left: Fig. 4—Internal helical splines or other conformations can also be produced by electroshaping

Right: Fig. 5—Machine for drilling, by the electroshaping technique, accurate small holes down to 0·012 in. diameter





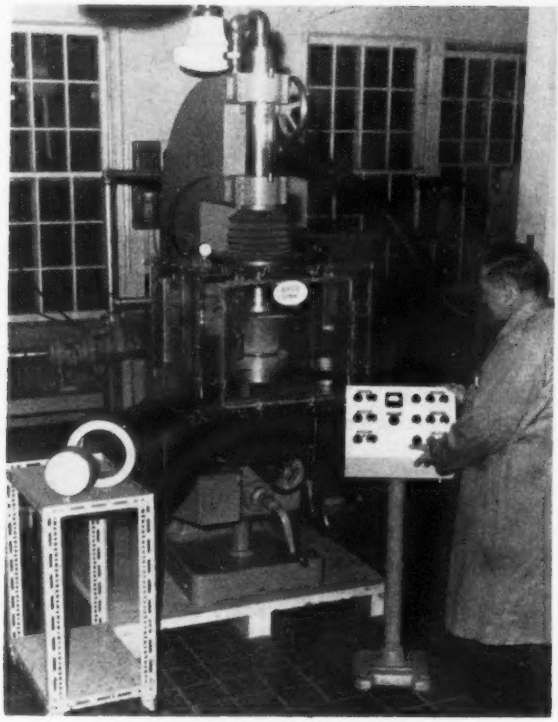
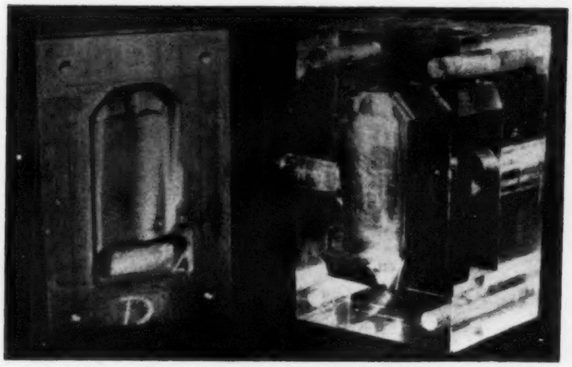
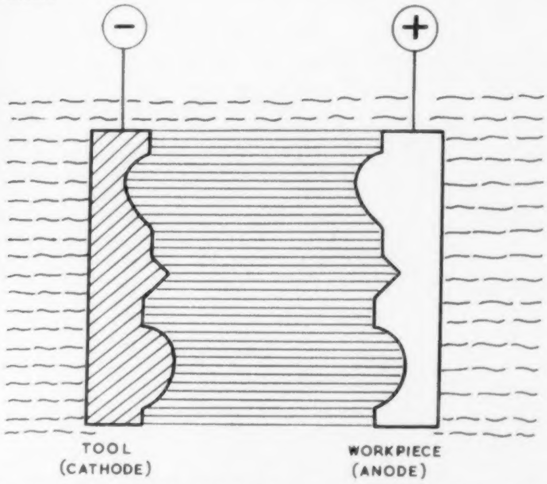


Fig. 6—A 10 in. diameter × $4\frac{1}{2}$ in. deep tungsten missile case has a 7 in. centre core removed in less than 5 hr. by electrolytic trepanning. Performed on a "Sifco-Sink" trepanning unit, the difficult alloy (85 per cent tungsten, 15 per cent molybdenum) is cut at 0·015 in/min. feed. Completed workpiece and trepanned centre core are shown on table at left



Above: Fig. 7—Forging die for turbine blade, with an impression 0·560 in. deep

Fig. 8—Diagrammatic arrangement showing method of electroshaping die blocks



metal and/or can be passed without boiling the chemical solution.

A forging die that requires 7 hr. or longer to make by usual methods can be electroshaped in 50 min., or in less than 1/7th the time. This is in material that conventional machining methods can handle before, but not after hardening. Electroshaping can handle the material in either condition (Fig. 8).

One high temperature alloy that wears out three drills and takes $1\frac{1}{2}$ hr. to produce an 8 in. hole has been electrolytically drilled in the same time, using only one drill — which remains reusable for many more times. Another high temperature alloy that cannot even be touched with the drills available, has been electrolytically drilled to produce an 8 in. hole in $1\frac{1}{2}$ hr.

Other features of significance in electrolytic shaping are:

(1) There is no physical contact between tool and workpiece. Hence, there is no pressure on the workpiece, and ultra-thin metals can be electroshaped as easily as heavy sections.

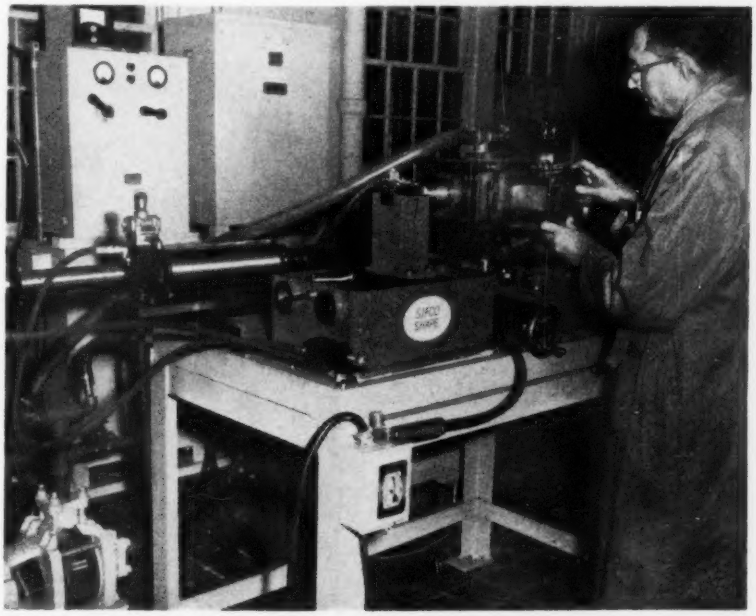
(2) Because there is no pressure, there are no burrs at cut edges. Indeed, the edges are naturally broken and are not sharp.

Turbine Blades

Precision machining of aerofoil sections normally provides an accurate and consistent product with superior finish

(*Continued on page* 71)

Fig. 9—Production electroshaping of precision turbine blades. Operator is shown loading one of the smaller "Sifco-Shape" machines with a forged blade. The blade is held in a special fixture which is inserted into the machine's plastics-walled shaping chamber



THEIR APPLICATION TO METALLURGICAL FAILURES IN AIRCRAFT

Investigational Techniques

By **D. A. RYDER,** M.Met., Dip.Phys.Met., A.C.T.(Birm.) A.I.M.

(*Concluded from* METAL INDUSTRY, 20 *January* 1961)

IT is difficult to define the border which separates fatigue and corrosion fatigue. Recent work[4] has shown that specimens fatigued in vacuum have lives many times longer than similar ones tested in air. On this basis, fatigue in air should properly be termed corrosion fatigue. On the other hand, the engineer understands the term as implying a considerable degree of visible corrosion.

Corrosion fatigue usually produces transcrystalline cracking. The most striking feature, apart from the presence of corrosion product is usually the multiplicity of cracks, only one or two of which propagate to a large extent. A wing spar that has failed by corrosion fatigue is shown in Fig. 21. There are many fatigue origins along the length of the drilled hole but only two have propagated extensively.

Recapitulating, it has now been shown that fatigue failure can be diagnosed by the appearance of the fracture surface. The geometry of the fracture can give an indication of the type of stress system that caused failure. It should also be possible to assess whether the presence of a geometric stress raiser, corrosion or fretting have played a significant part in the failure. In certain cases, however, the diagnosis of fatigue can be extremely difficult. For example, when fatigue failure occurs in thin light alloy sheet of the type used for aircraft skinning, fracture usually begins at the edge of a rivet hole. The area of fatigue fracture developed is usually small because of the high mean stress obtaining. Catastrophic failure then occurs by tearing. An example of this type is shown in Fig. 22. These failures seldom show the classic tide marks and there is little difference in the degree of deformation between the fatigue and tension zones of the fracture. It is in such cases as these that examination of the fracture surface at very high magnifications is most useful. The technique, so far as fatigue fractures are concerned, was first used by Zapffe and Worden[5], who called it "Fractography". They observed two features characteristic of fatigue fractures:—

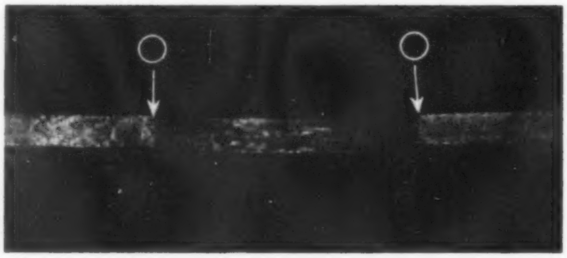
(1) A "platy" structure of bands normal to the direction in which the fatigue crack propagated (best observed at magnifications of $\simeq \times 500$) (Fig. 23).

(2) A lamellar or striated pattern in certain cases only just resolvable by the light microscope (Fig. 24).

Forsyth and Ryder[6] noted that these lamellae frequently lie on the tops of long plateaux (Fig. 25). The observed patterns are summarized diagrammatically in Fig. 26.

Work at R.A.E. on both service failures and laboratory fatigue specimens has led to the following

Left: Fig. 21—Corrosion fatigue fracture showing many origins along the surface of the transverse bolt hole



Right: Fig. 22—Fatigue fractures on each side of a rivet hole in aluminium alloy sheet

Fig. 23—"Platy Structure". Optical micrograph of a fatigue fracture surface. (× 200)

Fig. 24—Fine striations on a fatigue fracture surface. Optical micrograph (× 1500)

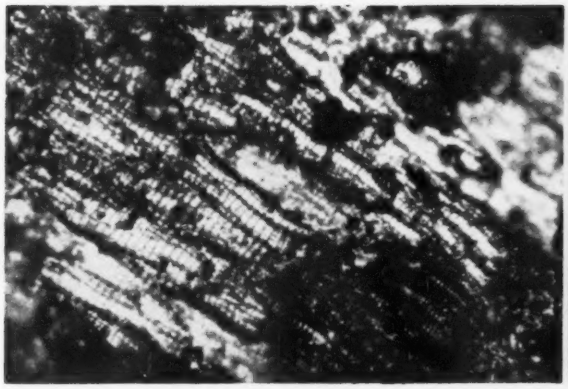


Fig. 25—Fine fatigue striations lying on plateaux which are roughly parallel to the direction of crack growth (× 250)

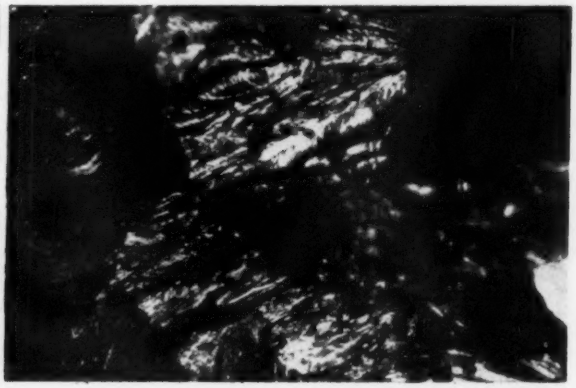


Fig. 27—Feathery pattern on fatigue fracture surface of DTD683 aluminium-zinc-magnesium alloy (× 200)

Fig. 26—Diagram showing the principal microscopic features of a fatigue fracture surface

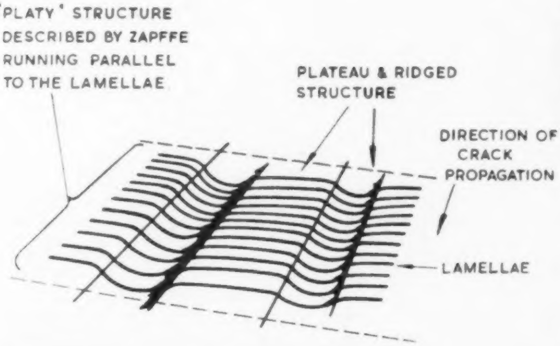
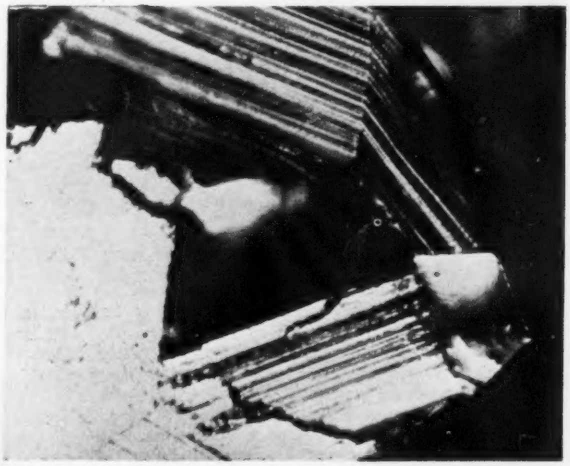


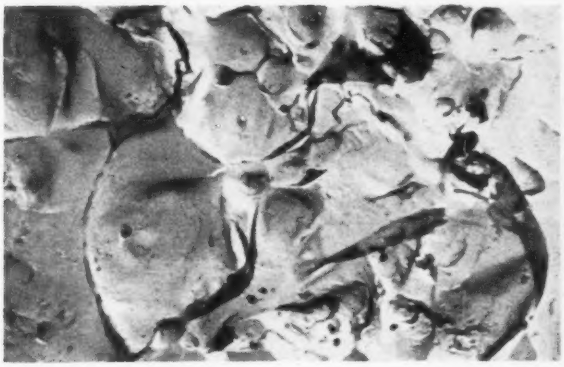
Fig. 28—Lamellar pattern on fatigue fracture surface of aluminium alloy fatigued in torsion at −196°C. (× 200)



Left: Fig. 29—Electron micrograph of the bright zone of a stress corrosion fracture surface. Aluminium-zinc-magnesium alloy, secondary carbon replica (× 20,000 reduced by ½)

Below Left: Fig. 30—Electron micrograph of a ductile tensile fracture surface showing dimples, many of which have a central compound particle. Secondary carbon replica (× 15,000 reduced by ½)

Below: Fig. 31—Electron micrograph of the surface of a 45° "shear" type tensile fracture. Elongated dimples with particles near one end. Secondary carbon replica (× 17,000 reduced by ½)



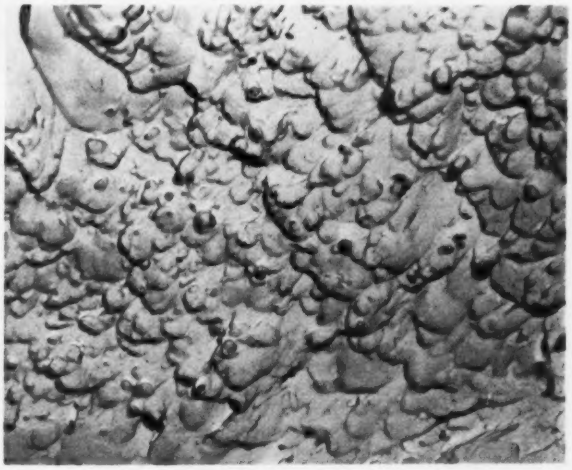


Fig. 32—Pattern of fine lines and loops on the fracture surface of a cast aluminium-silicon-copper alloy broken in tension. Optical micrograph (× 2,000)

Fig. 33—Electron micrograph of the same specimen as shown in Fig. 32. The innermost loops are polygonal and the fine lines are resolved as steps. Secondary carbon replica (× 14,000)

conclusions on the diagnostic use of fractography :—

(1) the "platy" structure described by Zapffe and Worden is not generally useful in diagnosing fatigue;

(2) The presence of fine striations on a fracture surface is good evidence that failure occurred by fatigue;

(3) The absence of striations does not mean that fracture was not by fatigue;

(4) The best striations are observed in reasonably ductile materials;

(5) Since striations lie normal to the direction of crack propagation they may be used to determine the direction of propagation and the origin of failure.

It is of interest to discuss briefly the nature of these striations which Zapffe and Worden believed to be associated with some fundamental cellular structure of metals. It has recently been shown[6] that each of these striations is produced by a single cycle of stress and that their mean spacing increases with increase in stress level. It therefore seems fairly certain that striations represent successive positions of the advancing crack front. This observation obviously permits the obtaining of quantitative information from measurements of striation spacing and some preliminary experiments have been discussed elsewhere.[6]

Patterns other than striations are observed on fatigue fracture surfaces. For example, Fig. 27 shows a "feathery pattern" that is characteristic of the very high strength aluminium alloys. The fracture surface of an aluminium alloy fatigued in torsion is shown in Fig. 28. The lamellar pattern almost certainly consists of slip bands, and the mechanism that produces it has been discussed by Stubbington.[7]

Stress corrosion can also be diagnosed by examining the fracture surfaces at high magnifications. An electron micrograph of the bright zone of a stress corrosion fracture surface (Fig. 29) shows a characteristic pattern consisting of a network of small but sharp tilts or a generally rather featureless grain boundary surface. The specimen was a laboratory test piece of aluminium-zinc-magnesium alloy which had failed after 95 days. The general roughening of the surface is probably due to corrosion of the fracture surface while the crack was still growing. Ductile tensile fractures are characterized by the pattern shown in Fig. 30. This consists of a pattern of immediately adjacent saucer-like depressions each usually having a particle of compound at its centre. The mechanism producing this pattern has been discussed by several workers[8,9,10] and is believed to involve the fracture of inclusions and the growth of the cracks so formed to give a multiplicity of voids which ultimately coalesce. Where a shear stress is superimposed upon the tensile stress, producing fracture, the voids are usually elongated as shown in Fig. 31. Intercrystalline brittle fracture in light alloy castings may, under certain conditions, produce patterns that can be confused with fatigue striations. An optical micrograph of such a pattern is shown in Fig. 32, and Fig. 33 is an electron micrograph of a similar field on the same specimen. Unlike fatigue striations, these lines often take the form of closed loops, and they do not lie on the characteristic plateaux. It is thought that this pattern of lines is produced by the interaction of elastic shock waves with the advancing crack front.[11] Somewhat similar patterns observed on the fracture surfaces of very high purity iron have been attributed to the effects of internal oxidation.[12]

It is apparent that the quite old, but rather neglected, technique of fractography is a most useful tool in failure investigation and in research into the mechanisms by which metals fracture.

The author is indebted to many of his colleagues for their help in the preparation of this Paper.

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Die-Casting Review

Die Storage

By P. J. MURCOTT and A. F. MURCOTT

ONE of the many problems of housekeeping that beset die-casters is that of die storage. In many pressure die-casting foundries, dies lie in a haphazard manner over a wide area of floor, where they collect dirt, impede movement and are difficult to find and remove. One foundry, that of J. V. Murcott and Sons Ltd., in the course of adding and equipping a new bay, set out to find a solution to this problem, and their resulting die storage system has some points of general interest. Based upon channel section racks, the dies can be identified at a glance, and all handling is by fork lift truck.

Part of the die storage system at the foundry of J. V. Murcott and Sons Ltd, showing dies being removed by fork lift truck

Small and Medium Dies

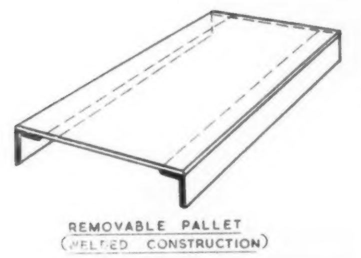
One end wall of the new bay has been fitted with racks for containing the small and medium-sized dies. The construction of these racks, and the pallets on which the dies are loaded, are shown in Figs. 1-3, and their size is designed to suit the 9 ft. and 12 ft. lift trucks in use. With a suitable truck, the height could, of course, be increased. As designed, each rack of three compartments wide holds 18 pallets, racks being multiplied as required.

The racks are entirely of bolted construction, the vertical members being 3 in × 2 in. channel section with 3 in × 3 in. angles forming the cross bearers. Each compartment is 1 ft. 9 in. wide and has 2 in × 2 in. angle iron runners, on which the removable pallets carrying the dies can be slid into position. Thus, the whole length of the pallet is supported.

The pallets themselves are of ¼ in. plate welded to 4 in × 3 in. angle runners (see Fig. 1) 1 ft. 7¼ in. wide, allowing the forks of the truck to enter between the angle sections.

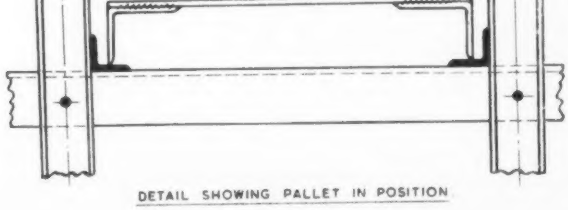
Large Dies

Many of the dies in operation at the foundry are much too large to be accommodated in the racks described. Larger and stronger racks have, therefore, been designed to take loads up to 2 tons in weight in each compartment and pallets 3 ft. 6 in. wide (Fig. 3).



Above: Fig. 1—Simple flat pallet used for small and medium sized dies. Of welded construction it is made from ¼ in. mild steel plate on 4 in × 3 in × 5/16 in. angles

Below: Fig. 2—Diagram showing position of angle iron runners supporting pallet



Right: Fig. 3—Racks of heavier construction and pallets with side supports are used for heavier dies

Construction is similar to the smaller racks throughout, but verticals are of 4 in × 2 in. channel section with 3 in. × 1½ in. channel sections for the cross bearers. In these racks there are three tiers of compartments, giving a total height of 8 ft. 6 in., with each compartment having a clearance height of slightly over 2 ft. 6 in.

For the heavy dies, flat pallets are inadequate, and pallets with two sides have been used, thus allowing, if necessary, a die-half to lie edge-on the pallet without risk of tipping off during loading into the rack. The pallet base is formed from two 2 in × 1½ in. RSC sections at the outsides, with RSL intermediate bearers in the centre (Fig. 3). Across these is welded a ¼ in. plate and an angle iron frame constructed at the front and rear, to which 10 gauge sheet is welded. As indicated in the diagram, two-way entry for the forks of the truck is provided, and safety is assured even when lifting a heavy die to the maximum height of 9 ft.

At the beginning of a job, i.e. when an order is first received, an identity number is allotted, and all castings, dies and other items relating to that order are identifiable by this number. Each compartment in the die storage racks has such a number printed clearly on the front cross member, and only the die bearing that number is stored there. Thus it becomes a very simple matter to locate a particular die in the racks once the reference number is known.

Feeding Die-Casting Machines

ORIGINALLY developed to feed automatically the Worswick-Baggeler range of automatic ingot casting and stacking machines, a range of molten metal metering pumps for magnesium, aluminium, zinc and lead is now available in smaller models for feeding die-casting machines with accurate quantities of molten metal.

The pump consists of a closed crucible of special material fitted with an inlet valve operated by an air cylinder through a push rod, and an outlet port (Fig. 1). The volume of metal displaced is controlled by the movement of the float which operates magnetic switches at the upper and lower limits of its stroke, and controls the maximum and minimum level of the metal within the pump. The metal is displaced by the admission of compressed air, or, if the metal is very susceptible to oxidation, nitrogen.

At the commencement of a cycle, the pump will be filled with metal to a level determined by the setting of the upper magnetic switch, and the inlet valve will be closed.

Where a single operation is required, as for filling a mould, the operation is started by an electrical impulse from a limit switch or push button, which energizes a solenoid operated pneumatic valve, allowing compressed air to enter the cylinder. This displaces the metal through the outlet port, and the level falls until the float operates the lower magnetic switch. When this switch is operated, the first pneumatic valve is de-energized, allowing the air to escape from the cylinder, and a second pneumatic valve energized to open the inlet valve. The metal then flows into the cylinder until the float is raised to operate the top magnetic switch, when the second valve is de-energized and the inlet valve closes.

Where this type of pump is used in a holding furnace in which the level is kept constant, it is extremely accurate, but where the level of the metal varies appreciably it is necessary either to adjust the metering valve to compensate as the level falls—which is done by merely turning a calibrated knob—or, in larger installations, by fitting the metering pump into a separate compartment, in which the level is kept constant by a second pump feeding from the main furnace. The excess metal overflows back into the main furnace.

Should the pump be used as a transfer pump, and operated from a liquid level switch, the circuit is rearranged so that the top magnetic switch re-starts the cycle so long as the liquid level switch is closed; alternatively, the pump may be operated at regular intervals by a timer.

The pumps are made in five sizes, which are adjustable up to a maximum displacement per operation of 110 in^3, 220 in^3, 350 in^3, 1,000 in^3 and 1,800 in^3.

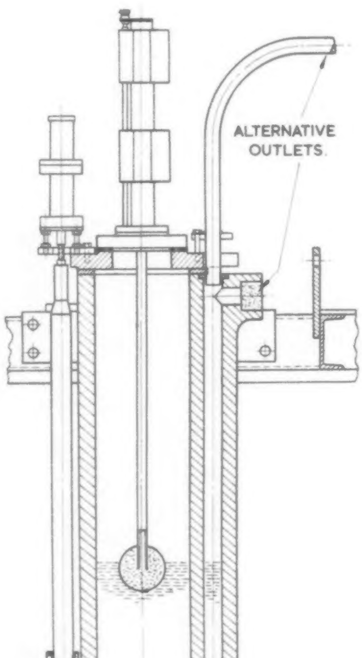
A special pump has been developed for the heavier metals, in which the accuracy remains constant, even though the level in the furnace varies considerably, but this pump is only suitable where the metal is clean, and does not contain an excessive amount of dross; such as in casting zinc slabs for rolling mills.

Holding furnaces, with indirect gas or oil heating, and equipped with this type of automatic metal feed for pressure die-casting machines, are being manufactured by Alan Worswick (Engineering) Ltd., Refuge Buildings, Ainsworth Street, Blackburn, who are licensees for the manufacture of the pumps.

In such holding furnaces for pressure die-casting machines, where the furnaces are fed by liquid metal from a central melting furnace, the metal must be held at the correct casting temperature.

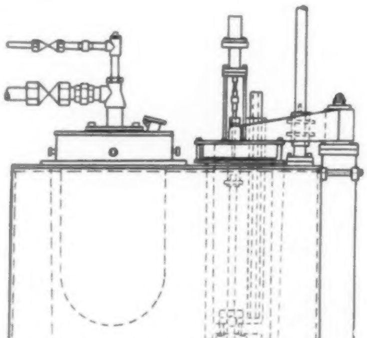
Since these furnaces are generally small units with a volume of about 15 ft^3, the use of surface heating by fuels such as oil or gas is unsuitable, and induction heated furnaces have been preferred for this purpose.

A furnace design has now been



Left: Fig. 1—Diagram showing arrangement of Worswick-Baggeler molten metal metering pumps

Below: Fig. 2—Holding furnace equipped with automatic metal feed for pressure die-casting machines



developed which uses an indirect heating unit immersed in the molten metal, and operates from either gas or oil. This gives the equivalent of induction heating with a lower initial cost and cheaper operation, due to the use of less expensive fuels.

The furnace is fitted with a molten metal pump of the type previously described for feeding accurately measured quantities of molten metal to the die-casting machine.

With this equipment, it is only necessary to depress a push button to feed the exact weight of metal required, thus eliminating the inaccuracies and wasted effort inevitable with the old method of transferring the metal from the furnace to the machine by a ladle.

The equipment is mounted on a frame which can be raised, or lowered, by a hydraulic cylinder for easy removal from the furnace.

Both the heating unit and metal feeding equipment can be supplied separately for incorporation into existing furnaces.

Men and Metals

News from Metal Industries Limited is that **Mr. R. J. F. Howard** has been appointed director of marketing. In this new post, Mr. Howard will be primarily concerned with the co-ordination of the marketing activities of the electrical companies within the group.

It is learned from Sterling Industries Limited that **Mr. P. M. W. Dean** has resigned from the board of the company.

A recent appointment to the board of Serck Limited is that of **Mr. Edward Blackwell Leach.**

To fill the vacancies caused by the resignations of **Mr. T. Jolly** and **Mr. C. R. Wheeler** from the board of Guest, Keen and Nettlefolds (South Wales), **Mr. L. R. P. Pugh** and **Mr. H. W. A. Waring** have been appointed.

It has been announced by British Titan Products Company Limited that **Dr. P. G. McCarthy** has been appointed a director of the company.

A member of the technical staff of Monsanto Chemicals, **Dr. L. S. Wilson** has been appointed to the newly-created position of senior scientist of the company.

Information from the governors of the Borough Polytechnic, London, is that they have appointed **Mr. J. F. Douglas,** M.Sc., A.C.G.I., D.I.C., A.M.I.C.E., A.M.I.Struct.E., as head of the Department of Mechanical Engineering in succession to **Mr. G. L. H. Bird,** who recently assumed an industrial appointment.

Formerly works manager at the Northampton works of Pollard Bearings Limited, **Mr. W. L. Watson** has now moved to the principal works of the company at Ferrybridge as works manager.

Leaving for India by air on Monday last, **Sir John Wrightson,** Bt., chairman of Head Wrightson and Company Ltd., will make a tour of some of the company's principal customers in Calcutta, Jamshedpur, Burnpur, New Delhi and Bombay. He will also be present when the new company, Head Wrightson India Ltd., officially commence operations in Calcutta.

It has been announced by the Consolidated Zinc Corporation Ltd. that **Mr. Paul V. Emrys-Evans,** vice-president of the British South Africa Company, has been appointed a director of the Corporation.

Two new appointments have been made by the Darlington Insulation Company Ltd. **Mr. S. Watson** is to be northern regional manager, and **Mr. A. W. D. Pullar** has been appointed southern regional manager. Both these gentlemen have been with the company for 22 years.

An electrical sales engineer with automation and semi-automation background, **Mr. B. B. Mann** has joined Electrical Remote Control Company Limited and will be concerned with that company's technical advisory service on the application of process timing equipment to industry.

Appointed general sales manager of James Booth Aluminium Ltd., **Mr. T. K. Singer** was formerly an executive with Kaiser Aluminum and Chemical Corporation, and has represented that company both in the U.S.A. and in this country. **Mr. Frank J. Mills** continues as sales manager of James Booth.

A subsidiary of Brightside Engineering Holdings, Graham Firth Steel Products have appointed **Mr. L. Graham Firth** chairman in place of **Mr. E. H. King,** who remains on the board. **Mr. Tom C. Firth** and **Mr. R. Ivor Slater** have been elected to the board, and **Mr. A. R. Lancashire** has been appointed assistant managing director. **Mr. N. G. Welch** and **Mr. B. J. Byrne** have relinquished their seats on the board. **Mr. H. J. Nash** has succeeded Mr. Byrne as secretary.

We are informed by Stordy Engineering Limited that **Mr. W. G. J. Appleton,** M.I.Mech.E., M.Inst.F., has been appointed a director of the company.

Electroshaping—*continued from page 65*

free from surface contamination. The method is economical on easy-to-machine materials, but becomes less attractive for difficult-to-machine materials, and where resultant waste is a significant cost element. With the more highly alloyed materials there is danger of introducing machining stresses which contribute to warp and distortion problems in service. Initial tooling cost is extremely high and the method is not considered economical for small quantities.

Electrochemical shaping of aerofoils (Fig. 9) not only offers substantial savings over methods used previously but also provides the potential for greatly improved dimensional accuracy. Tooling can also be produced by similar techniques.

The approach followed up to the present has been to produce a slightly oversize forging, allowing a band of material for subsequent removal by electrochemical techniques. This permits the use of considerably wider dimensional tolerances on the forging and provides increased die life in consequence. Inspection of the forged product is reduced appreciably as compared with that necessary for precision forgings, and production off the forging equipment is increased due to the less critical nature of the product required for subsequent electrochemical correction.

While the work has so far been confined to electrochemical shaping oversize forged blades, the process is readily applicable to castings or bar stock. The overall tooling cost following this approach is considerably less than would be required for production as a precision forging, and the life of the electrochemical shaping tools appears to be of considerable duration. Superior surface finishes are being consistently obtained, stress problems are completely eliminated, warp, bow and twist tolerance requirements can be drastically reduced, section thicknesses are no longer a factor, and aerofoils with leading and trailing edges as thin as 0·005 in. are being successfully produced. Contour control is good and reproduction is excellent.

Blade materials being electrochemically shaped include: stainless steels, both pearlitic and austenitic grades; S-816; Waspalloy; Udimet 700; Nimonic; A-286; and V-57. In other applications, tungsten and molybdenum are being successfully shaped.

Editorial Note—Attention is directed to the machines "Sifco-Cut", "Sifco-Sink" and "Sifco-Shape" mentioned in this article, which should not be confused with the products of Suffolk Iron Foundry (1920) Ltd.

SOME A.E.I. INSTALLATIONS AND CONTRACTS IN THE NON-FERROUS INDUSTRIES

Industrial Electrical Equipment

IN the heavy industrial field, 1960 produced a considerable demand for electrical equipment, and the following paragraphs briefly outline some of the more important contracts handled by Associated Electrical Industries (Rugby) Ltd.

For a continuous electrolytic tinning line at the Australian Iron and Steel Co. Ltd., at Port Kembla, motor-generator sets, booster sets, Magnestat amplifier control and approximately 150 direct-current drive motors were ordered. The plant will have an initial speed of 850/1,000 ft/min., which will be raised ultimately to 1,700/2,000 ft/min.

Also in Australia, Broken Hill Proprietary Ltd. has ordered electrical equipment for a new rod mill. The mill will be driven by D.C. motors with a total output of 17,700 h.p., supplied by five mercury-arc rectifiers with a total capacity of 14,500 kW. Control gear auxiliary drives, switchgear and other equipment will also be supplied.

Amongst orders for aluminium foil mills is one from Fishers Foils Ltd., which includes a 600 h.p. 400/900 r.p.m. D.C. motor supplied from a motor-generator set. Associated with this mill is a Magnestat-controlled coiler.

At Rogerstone, Monmouthshire, Alcan Industries Ltd. (formerly Northern Aluminium Co. Ltd.) commissioned a 144-in. hot reversing mill and an associated 88-in. hot finishing mill. Two 4,000 h.p., 30/60 r.p.m. D.C. motors, with a combined peak output of 24,000 h.p., drive the 144-in. mill. This main drive takes its supply from an Ilgner m.g. set consisting of four 1,600 kW, 750 r.p.m. generators driven by an 8,000 h.p. induction motor. Two 200/400 h.p., 420/840 r.p.m. D.C. motors drive the screwdowns, and two 350 h.p., 650 r.p.m. motors the slab shear. The main exciter set (which includes exciters and generators for the screwdown motors) is driven by a 1,000 h.p. synchronous motor; while another m.g. set, also driven by a 1,000 h.p. synchronous motor, supplies the slab shear motors. The auxiliary motors include eleven of 73/150 h.p., 515/1,030 r.p.m., for driving the tables. These are supplied by three mercury-arc rectifier/inverter units, each rated 658 kW at 470 volts. Electronic control of the rectifiers, and also of the reversing switch in the main motor circuit, has also been provided by A.E.I.

In the 88-in. mill, a 4,000 h.p., 150/300 r.p.m. motor was supplied for an additional stand, and another 4,000 h.p. motor substituted for an existing machine. All the main motors on this mill are now supplied with their own mercury-arc rectifier unit with grid control for motor starting, two of them rated at 3,240 kW at 675 volts, and the third 2,120 kW at 440 volts.

A Sendzimir mill, reputed to be the first European strip mill of its kind for cold rolling, was commissioned early in the year at Birmetals Ltd. The A.E.I. Heavy Plant Division provided two coupled 900 h.p., 500/1,000 r.p.m. D.C. motors to drive the mill, and six 350 h.p., 500/1,250 r.p.m. motors to drive the reels.

A 3,500 h.p. synchronous motor drives the D.C. generators (two of 750 kW, two of 870 kW). Forced ventilation from below is provided for all the motors and for the main m.g. set.

Metal processing and electro-chemical applications have been particularly prominent during the year, the largest single order being one for a 42 MW installation consisting of six germanium rectifier units to supply an extension of the Australian Aluminium Production Commission's aluminium smelting plant at Bell Bay in Tasmania.

A new development is the application of germanium rectifiers to the continuous tinplating of steel strip. An order from the Steel Company of Wales Ltd., at Trostre Works, for twenty germanium rectifiers, is for a tinning line comprising a cleaning tank, two pickling tanks, eight plating tanks, and a chemical treatment tank. The speed of the strip can be varied between 250 ft/min. and 1,500 ft/min., and the electronic control gear, which is being supplied by Electronic Apparatus Division, will automatically maintain the relationship between current and strip speed correct and constant to within $\pm 0{\cdot}5$ per cent at any speed within the range.

The cleaning and pickling tanks are each supplied by one 240 V, 14,100 amp. rectifier, and the chemical treatment tank by one rated 18 V, 9,400 amp. For the plating tanks, a total of sixteen 18 V, 9,400 amp. rectifiers will be provided. It is possible to control independently the thickness of plating applied to each side of the strip to take care of such requirements as, for example, tinplate for food canning, which needs to be more heavily coated on one side than on the other.

During October, a semiconductor rectifier installation was put into commission at the works of the Electrolytic Zinc Co. of Australasia Ltd., at Risdon, Tasmania, comprising two germanium rectifier units, each capable of a D.C. output of 11,250 amp. at 678 V.

Correspondence

Correspondence is invited on any subject considered to be of interest to the non-ferrous metal industry. The Editor accepts no responsibility either for statements made or opinions expressed by correspondents in these columns

Sampling Metals and Residues

TO THE EDITOR OF METAL INDUSTRY

SIR,—The article "Sampling Metals and Residues", by Mr. F. L. Jameson, in your issue of 13 January, p. 28, was both interesting and intriguing—interesting because of the methods given for sampling notoriously difficult metal residues, and intriguing to find such support from a firm of well-known public analysts for my own strong views on the importance of sampling. I was under the impression that all the plums in that profession came from doing referee assays arising largely from bad sampling.

Seriously, it has been my experience that more disputes arise through bad sampling than bad assaying, and largely because there is little appreciation that the object of sample preparation is to produce a homogeneous state from a very heterogeneous one.

I should like to suggest that the Metal and Waste Traders' Association, the metal refiners and other interested bodies get together on this matter and agree on the following points. First, the sampling method for the main grades of scrap and residues regularly arising in the trade, and certainly including the two difficult ones mentioned by Mr. Jameson. Secondly, agreement on the maximum particle size for "fines", and here I would say −60 mesh, as mentioned. Finally, that the method of assaying should also be agreed upon, and the splitting limits on the assay figure before going to reference.

I raise the last point because, in spite of the difficulties in producing a representative homogeneous sample from, for example, a copper refining residue, some firms insist on a splitting limit of 0·3 per cent when two accepted methods will always and consistently vary more than this, and each works laboratory is sure that its own method is best.

Having set our own house in order, perhaps the Continent could be brought into line at a later date.

Yours, etc.,

H. Bootman,
Works Director,
Lead and Alloys Limited.

Colonial House,
Mincing Lane,
London, E.C.3.

Industrial News *Home and Overseas*

London Metal Exchange

On Tuesday, April 25 next, the **Lord Mayor of London** will open the rebuilt London Metal Exchange in Whittington Avenue, E.C.3. The same evening, the **Rt. Hon. Iain Macleod,** M.P., Secretary of State for the Colonies, will be the guest of honour at a dinner, to be given by the London Metal Exchange at the Savoy Hotel, to mark the occasion.

News from Scotland

According to reports from Glasgow, **Guest, Keen and Nettlefolds Ltd.** have paid £90,000 for the full shareholding of the electroplating company of Airlite Engineers Ltd., of Edinburgh. This company, established in 1947, employs some 120 workpeople, and plans are being made to expand and modernize the works.

A plant said to be unique in Scotland is the new bronze-casting concern which is operating under the name of **Dens Metals (Dundee) Ltd.** Its products, marketed under the trade name of "D-bron", are in solid bar or tube form in lengths of up to 9 ft.

The Ailsa Shipbuilding Company Ltd., of Troon, has been given authority to go ahead with another phase of their £500,000 modernization scheme. Work is to start in the spring on the new plating shops, equipped with modern plant, and a travelling overhead crane capable of handling units from 5 to 15 tons.

New Blast Furnace

It is learned from **Ashmore, Benson, Pease and Company Ltd.** that they have been awarded a contract by the Ford Motor Company Ltd., of Dagenham, to construct a new blast furnace with a hearth diameter of 20 ft. The new furnace is planned to go into production in the summer of 1962.

On Show

At the forthcoming Hardware Trades Fair, **Garringtons Limited** will be exhibiting on Stand A 24 a full range of "Red Diamond" and "Blue Diamond" hand tools. The exhibit will include double-ended open-ended spanners and double-ended ring wrenches in Whitworth, Unified and Metric sizes, tapper spanners, the "CT" adjustable wrenches, tool kits, socket sets, hammers, etc.

New Aluminium Rolling Mill

It has been reported from Sheffield, Alabama, that a new United States aluminium rolling mill has been put into operation at the Reynolds Metals Company alloys plant there. Both the 170 in. wide reversing mill which opens the new line and the four-stand 120 in. continuous strip mill at the other end are stated to be the widest aluminium rolling mills in the world.

Award for Powder Metallurgy

A note from New York states that the board of governors of the **Metal Powder Industries Federation** is to sponsor an award for outstanding contribution to the advancement of the metal powder and powder metallurgy industry. It will be known as the M.P.I.F. "Powder Metallurgy Progress Award" and will be made to an individual or institution, regardless of nationality, whose efforts have contributed substantially to the advancement of the industry.

Presentation of the award will be made at the annual technical meeting of the Federation, which is being held in April this year.

Moving Coil Meter

What is stated to be the world's largest moving coil meter—about 17 ft^2—will overlook the forthcoming **Electrical Engineers Exhibition,** which is to be held in March next at Earls Court, London.

The meter scale will be more than 20 ft. long and will show the total electrical load connected during the exhibition. Mounted on the first floor by the Warwick Road entrance, the total weight of the instrument will be over 3 cwt., of which about one-tenth will be magnet. This will drive a 5 ft. long aluminium pointer whose indications on the scale will be easily readable from more than 100 yd. The instrument will register in the region of 4 MW, and the scale will be calibrated 0—5 MW. The movement and dial have been designed and constructed by Nalder Bros. and Thompson Ltd.

A Birmingham Event

On Wednesday next, February 1, the monthly luncheon of the **Non-Ferrous Club** will be held at the Queen's Hotel, Birmingham, at 12.30 p.m., at which the guest speaker will be Mr. R. C. Hilton, the divisional traffic manager of the Western Region, British Railways, and the subject of his talk will be "Future Railway Policy".

Trade with Turkey

A further list (the sixth) of global import quotas and an extended liberalization list was recently announced by the Turkish Government. In the list of quotas the following are included: aluminium sheets, etc., $300,000.

The following items have been added to the previous liberalization list: aluminium powder and raw magnesium.

Rolling Mill Contract

An order valued at approximately £1,000,000 has been placed by the English Steel Corporation Limited with the **Brightside Foundry and Engineering Company Ltd.** to build the bar mills for the new Tinsley Park works. This follows the announcement earlier this month that the contract for the blooming and billet mills for the same project had been awarded to Davy and United Engineering Company Limited and the Brightside Foundry and Engineering Company Ltd., acting together as a specially formed consortium on this occasion.

This further order, which has been gained in the face of intense home and foreign competition, is for a highly mechanized and versatile plant specifically designed for the production of alloy and carbon steel bars of high accuracy and quality at high rates of output.

Platinum Metals in Industry

A new publication has recently been produced by **Engelhard Industries Ltd.** (Baker Platinum Division) in which is outlined some of the many uses of the platinum group metals. Included in this brochure are details and photographs of thermocouples, resistance thermometers, electric furnace windings, electrical contacts, potentiometer windings, sparking plugs, while references to the use of platinum, palladium, rhodium and ruthenium in the field of electroplating are also given. Copies of this brochure may be obtained from the company.

Expansion Continues

Work is now well advanced on another large modern building at the Cambridge works of the **Cambridge Instrument Company Ltd.** This new building, which will be similar in appearance and joined at one end of the company's new research laboratories, will consist primarily of two floors supported at first floor level by a series of reinforced concrete pillars.

The top floor will house testing, assembly and wiring departments, and the first floor will be devoted to enlarged production space for the company's microscan X-ray analyser and to works offices. The area beneath the first floor will be almost wholly taken up by parking space and a loading bay with a gantry and platform.

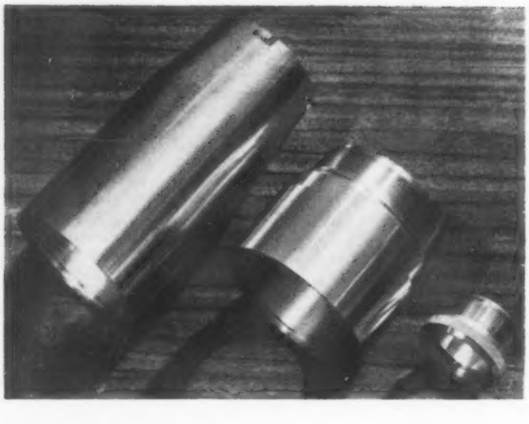
The building is expected to be ready for occupation in July this year, and the mode of construction will give a clear area on all floors uninterrupted by columns or beams. Extensive use is also being made of new materials and techniques.

Superheated Steam

Early notice is given of a conference on the condensation of superheated steam to be held on Tuesday and Wednesday, March 14 and 15 next, at the National Engineering Laboratory, East Kilbride.

The laboratory is working on the feedheater problem, and is considering extending this work into the process field. The conference will thus serve both to make clear the existing state of knowledge in this controversial field and to ensure that the work at N.E.L. will embrace those aspects of the problem of most interest to industry. Much of the time will, it is hoped, be occupied by informal discussion, but a few Papers will be presented to stimulate discussion. These include a survey of the existing state of knowledge as shown in published work, presented by N.E.L.; Papers by Mr. J. L. Gray, of the Central Electricity Generating Board; and Dr. R. S. Silver and Dr. H. Simpson, of Messrs. G. and J. Weir; and two short Papers by N.E.L., describing the experimental feedheater rig which is now being assembled, and a method of using a digital computer for designing feedheaters.

It is emphasized that, although much of the material discussed will inevitably be theoretical, the ultimate objectives are strictly practical. It is hoped that the conference will attract engineers and others concerned with problems and developments in this important subject. Further information may be obtained from the Director (Heat Division), National Engineering Laboratory, East Kilbride, Glasgow.



Lens-mount components, made by Taylor, Taylor and Hobson at Leicester, in Noral 28S aluminium machining alloy

Noral Machining Alloy

Production problems in the machining of photographic and television lens-mount components at the Leicester works of Taylor, Taylor and Hobson Ltd., are said to have been considerably eased by the adoption of **Alcan Industries Limited's** machining alloy, Noral 28S.

The machining properties of this alloy are considered to be such that there is no build-up of metal on the cutting edge and no long, continuous strands of swarf. Noral 28S is normally supplied as rod or bar in sizes up to about 4 in. diameter, but is also available in the form of drawn wire, tubing and simple extruded sections.

The alloy readily accepts a corrosion-resistant anodic film, and the ability of such films to absorb coloured dyes is exploited in the production of these lens mounts by using a black anodized finish as a base for the usual matt black enamel on all inner surfaces. The outer surfaces of many of these lens mounts, particularly those that may have to stand up to agressive conditions, are coated with a protective layer of synthetic resin lacquer. In certain cases, however, small components, such as iris control rings, are anodized and lacquered to give a high satin finish.

Press Brake Guard

It has been announced by **Rubery Owen and Company Ltd.** that they have decided to discontinue the manufacture of the Rubery Owen Press Brake Guard and that they are now winding up this business. Guards at present on order will be completed and orders for a limited number of guards for completion between now and the end of April next, will be accepted.

The company will also continue to supply spares during the next twelve months, but from the end of April it will not be able to give maintenance service.

New Regional Office

As from February 1 next, the Eastern Regional staff of **British Insulated Callender's Cables Ltd.** will be operating from premises in Chelmsford. The address is: Friars Walk, Friars Place, Chelmsford, Essex, and the telephone numbers are Chelmsford 58171/2. Stores will be established in the near future.

The region will continue under the management of Mr. T. C. Johnston, who was appointed to the position in February of last year.

Canadian Metals for India

India is to get $11,700,000 worth of aluminium, copper and nickel from Canada under the Colombo Plan in 1960/1961, Mr. Howard Green, the Minister for External Affairs, told the House of Commons in Ottawa last week.

The allocation heads a list of $22,800,000 in gifts to India which, as in the past, is to receive half of Canada's Colombo Plan contribution during the fiscal year ending next March 31. Mr. Green said that the industrial metals would be shipped without delay.

Powder Metallurgy

Under the auspices of the Powder Metallurgy Joint Group of the Iron and Steel Institute and the Institute of Metals, the following meetings will be held this year:

Discussion on "The Appraisal of Powders for Pressing and Sintering: I—Techniques for the Evaluation of Powders; II—The Relationship Between Powders and their Pressing and Sintering Behaviour", Monday and Tuesday, April 17 and 18, at The Royal Commonwealth Society, London, W.1.

Symposium on "Sintered High-Temperature Oxidation-Resistant Materials", Thursday and Friday, December 7 and 8, at Church House, Great Smith Street, London, S.W.1.

Change of Name

News from H. and E. Lintott Limited, of Horsham, is that they have changed their name to **Lintott Engineering Ltd.** The company is a member of the Ayling Industries Group.

Furnace Installation

It is learned from **Efco Furnaces Ltd.** that they have received orders for further extensions to their furnace installation at the United Wire Works Ltd., Edinburgh. The orders cover the supply of a 200 kW pit pot furnace for bright annealing eight-ton charges of phosphor bronze wire, and a bell furnace installation with two furnaces and eight bases.

The bell furnaces will also be rated at 200 kW, and every base will provide a loading space 48 in. in diameter by 60 in. high, and accommodate charges weighing up to 10 tons.

A Competition Award

A two weeks' tour of Germany, followed by a week-end in Paris, was the reward for Mr. L. A. S. Harbourne, an area representative of the crucible department of **The Morgan Crucible Company Ltd.**, as winner of a sales competition organized by the company.

Mr. Harbourne far exceeded a target set for sales of "Suprex" carbon-bonded silicon carbide crucibles, which are the latest addition to the "Salamander" range of crucibles manufactured by the company. Next year Mr. Harbourne will have completed 30 years with the company.

A Bale-out Furnace

For aluminium pressure and gravity die-casting production, **Monometer Manufacturing Company Ltd.** offer a dry hearth melting bale-out furnace which is constructed so that melting can go on continuously or intermittently as production requires.

The aluminium is loaded from the back of the furnace on to a sloping hearth, where the melting takes place. The molten aluminium flows down the hearth to the holding bath located at the lower end of the furnace, where it is held at close temperatures for ladling into dies or pressure-casting machines. The furnace is oil-fired or gas-fired.

The makers state that this furnace has a low fuel consumption, no chilling of metal, eliminates temperature variations, and no casting hold-ups. There is no gas pick-up, a constant supply of uniform castings, and is economical in floor space. A leaflet describing this furnace has just been issued.

New Aluminium Foundry

Construction of the new factory at Beverley, Yorks., for the Deans and Light-alloys division of the **Manganese Bronze and Brass Company Ltd.** is now virtually complete. Among the equipment chosen for this factory—80,000 sq. ft. in area, and one of the largest in the country — are several overhead cranes manufactured by Matterson Ltd., of Rochdale.

This new factory is a part of the general re-organization of the Manganese Bronze group, which was recently announced. Plant for the manufacture of railway and marine doors and other aluminium cast components has been transferred gradually from the old Lightalloys Ltd. factory, in Willesden, Yorkshire, by road and rail with remarkably slight interruptions to production. This transfer will be complete, and the new foundry in full operation by the end of next month.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week rose 53 tons to 10,040 tons, comprising London 4,264, Liverpool 3,941 and Hull 1,835 tons.

Copper stocks rose 375 tons to 15,320 and were distributed as follows: London 1,375, Liverpool 11,195, Birmingham 400, Manchester 2,300 and Hull 50 tons.

Career Booklets

A new series of I.C.I. booklets have been published recently and these have been designed to give to graduates, both arts and science, who may be looking enquiringly towards the company for information on career prospects, a more realistic and detailed picture of the company than they might expect from the traditional type of recruitment publication.

Following the practice adopted with the first booklet in the series, the company asked a distinguished journalist to visit the I.C.I. manufacturing divisions and talk to as many members of the staff as he wished. The results of his visit are contained in the second booklet of the series entitled "A High Degree of Engineering".

Both this booklet and the first one,

entitled "A Degree Nearer Industry" (written for the arts graduate), should be of great value to those graduates interested in the wide range of activities pursued by Imperial Chemical Industries Limited. Copies of these booklets may be obtained from the Recruitment Section of I.C.I., Millbank, London, S.W.1.

Agreement on Uranium

An announcement was recently issued jointly by the Minister of Mines for South Africa and the United Kingdom Atomic Energy Authority as follows:—

Discussions between the South African Atomic Energy Board and the Combined Development Agency, held during November and December, 1960, have resulted in agreement between the Board and the Agency's constituent partners, the United States Atomic Energy Commission and the United Kingdom Atomic Energy Authority, on a number of important aspects of the South African uranium production programme.

At these discussions, which were first commenced on an exploratory basis in February of 1960, the parties came together in the light of experience gained under the arrangements between the Board and the Agency which have been operative since 1952 to consider, from the point of view of the Agency, a stabilization of the price for material supplied by South African producers and a rearrangement of the quantities to be delivered, and from the point of view of the Board, the extension of the period of operation of the existing arrangement so as to ensure the continued operation of the South African uranium industry beyond the date of expiry of the current production programme. These complex issues have been resolved and agreements have been entered into by the Board separately with the United States Atomic Energy Commission and the United Kingdom Atomic Energy Authority.

These new agreements, which will operate from January 1, 1961, take the place of the present arrangements between the Board and the Combined Development Agency, which provide for the acquisition by the Agency during the six year period January 1, 1961, to December 31, 1966, of 28,350 tons of uranium oxide, equivalent to an average rate of 4,725 tons per year at prices varying as between individual producers and calculated on an incentive cost type formula. In terms of the new agreements, the total quantity of material to be acquired by the Commission and the Authority remains unchanged, but a reduced rate of delivery will result in the deferment of 5,953 tons for delivery to the Authority in the United Kingdom during the period January 1, 1967, to December 31, 1970, while the average combined rate of delivery to the Commission and the Authority during the six year period ending December 31, 1966, will be reduced from 4,725 tons to 3,733 tons.

In lieu of the former price arrangement, agreement has been reached on a fixed price for the total tonnage to be acquired by the Authority and the Commission. This will enable each producer to receive a price related to that received by it hitherto.

These features of the new agreement have been made possible through the realization by all concerned of the advantages to be gained by such rationalization of the South African uranium industry as should prove to be feasible through the transfer of production from high to low cost producers. The new agreements will enable such transfer of production to be effected on the authority of the Minister of Mines for South Africa after recommendations by the Atomic Energy Board, and the reduction or cessation of operations by certain production units will result.

As part of the new price arrangements, the agreements now concluded provide for the transfer to South African uranium producers of ownership of Calcined Products (Pty.) Limited, which company has been responsible for the processing of the material prior to its shipment, and undertakings have been given to maintain the quality of the material at the same high standard as hitherto.

It is mutually felt that the new arrangements represent a solution which will be beneficial to the parties concerned.

Metal Finishing

On Thursday next, February 2, a meeting of the North-West Branch of the **Institute of Metal Finishing** is to be held at the Apprentice School, de Havilland Propellers, Lostock, Bolton, when Mr. E. Johnson will present a Paper on "Paints for the Sixties". The meeting is scheduled to commence at 7.30 p.m.

New Factory

Additional factory premises in Wimbledon, London, S.W., have been acquired by the **British Rototherm Company Ltd.**, the scientific instrument makers. This new factory is being equipped with the most modern plant and will accommodate a machine shop, dial thermometer production unit and bulk stores.

Price Reductions

It is announced by **Lancashire Dynamo Electronic Products Ltd.**, of Rugeley, that, as a result of large-scale production and improved methods of manufacture, an immediate price reduction is being made on their series SME.2 smoke alarm and densitometer equipment. The equipment is designed to monitor the density of smoke emitted from chimneys as a protection against the infringement of the Clean Air Act.

The Series SME.2 equipment, which, we understand, was the first of its type to be awarded the British Standard Institution's "Kite-Mark" certifying full compliance with B.S.S. 2740 and 2811, is in quantity production, and deliveries of basic installations can be made from stock.

Aluminium in Argentina

According to news from Paris, officials of the Pechiney Company, the large French chemical and aluminium producer, are in Argentina at the moment to discuss with the Argentinian Government the possibility of building an aluminium plant there, a spokesman for the company told Comtelburo.

The talks are taking place in conjunction with the U.S. concern, Kaiser Aluminum, with which Pechiney is already associated in a similar venture in Spain. The plan put forward by the two companies envisages a plant with an annual capacity of 25,000 tons.

Ideal Homes

At the forthcoming **Ideal Homes Exhibition**, to be held at Olympia, London, in March next, the domestic uses of metal in all its various forms will again be demonstrated by a large number of firms. The larger household appliances, such as refrigerators, cookers, washing machines, boilers, and so on, will be shown in the exhibits of such firms as The General Electric Company Ltd., The English Electric Company Ltd., etc.; Anodised Products Ltd. will be exhibiting their complete range of aluminium ware, and aluminium cooking utensils will be shown by Falconware Products.

Ladders in steel and aluminium, garden trucks and serving trucks, and a selection from their range of stairways will be exhibited by H. C. Slingsby Ltd., while Drew, Clark and Company Ltd. will have a wide range of their "Diamond" ladders in aluminium alloy, steps and kitchen stools on display.

Firth Cleveland Tools Ltd. will be exhibiting all the various kinds of "Surform" hand tools, together with a selection of attachments for power tools. Stanley Works (G.B.) Ltd. will also be showing and demonstrating a variety of their tools, including the "Yankee" spiral ratchet screwdrivers, portable vices, trimming knives, etc. The exhibition, organized by the *Daily Mail*, will open on March 7.

Italy and Customs Duties

The Italian Government has announced that it has asked the Council of the European Economic Community to authorize postponing reductions in customs duties on some products traded in the Community. Among products listed in the request are lead oxide and strip, sheet, tubes and pipes of lead and zinc; accumulators and electric cables.

The duties reduction should have come into force on January 3, but for these products the Italian Government has decided on a temporary suspension of the measure while awaiting the authorization it has requested.

The Government's reason for the request is that Italian industries manufacturing these products need special measures because they have to buy at dearer prices than the same industries in other Community countries.

Forthcoming Meetings

January 28—Institute of Metal Finishing. North-West Branch. Kent Suite, Belle Vue Gardens, Manchester. Annual dinner and dance. 6 p.m.

January 30 — Institution of Plant Engineers. West and East Yorkshire Branch. Houldsworth School of Applied Science, Leeds University. "The Uses of Molybdenum Disulphide." G. J. Vineall. 7.30 p.m.

February 1—Institute of British Foundrymen. North Lindsey Technical College, Kingsway, Scunthorpe, Lincs. "Fifty Years of Progress in Jobbing and Repetition Foundries in Great Britain." A. S. Beech. 7 p.m.

February 2 — Birmingham Metallurgical Society. College of Technology, Gosta Green, Birmingham. Students' Evening. Conversazione and Exhibition. 6.30 p.m.

February 2—Institute of Metals. London Local Section. 17 Belgrave Square, London, S.W.1. "The Development of Some New Bearing Materials." P. G. Forrester. 6.30 p.m.

Metal Market News

THE December copper statistics, which appeared last week, created something of a sensation on account of the remarkable increase in the total of deliveries of refined copper to consumers outside the United States. The details, in short tons of 2,000 lb., are as follows: Inside the U.S.A., production of crude copper was unchanged at 110,098 tons, while refined output increased by 3,000 tons to 152,211 tons. Deliveries, at 91,163 tons, showed a drop of about 8,600 tons, and stocks of refined copper in the hands of the producers went up by about 9,000 tons to 139,272 tons. Outside the States, output of crude copper rose from 195,557 tons in November to 206,081 tons and of refined from 158,420 tons to 166,529 tons. Deliveries, at 225,811 tons, advanced by more than 40,000 tons from the November figure of 186,271 tons, but stocks dropped by 9,400 tons to 288,510 tons. Current comment is that the much increased total of deliveries was due partly to a build-up of stocks in anticipation of a Braden strike, but also to the customary boosting up of intake at the year end for considerations of tax. The combined total of getting on for 320,000 tons of deliveries to consumers is certainly an impressive figure which, however, nobody expects to see repeated.

In copper, last week was an eventful one, starting off with a rise of 786 tons in warehouse stocks to 14,945 tons. Rumours of impending cuts in production were circulating, and on Tuesday morning it was known that the Southern Peru Copper Co. intended to reduce their output by 15 per cent, based on the second half year's blister production, the amount of copper involved being about 2,100 tons monthly. Much later in the day, word came through that Anaconda intended to cut by 10 per cent their production in the United States and Chile. This news was available to the Kerb market in the afternoon, which showed a firm trend. Two days later, on Thursday, Kennecott reported their decision to lop 4,500 tons monthly off their North American production but to take no action in Chile. On Wednesday morning it was known in London that Kennecott had reduced its selling limit by 1 cent to 29 cents, and this was quickly followed by a similar report by Anaconda. It is not surprising that the London market, under the influence of production cuts and price reductions, indulged in see-saw price movements, but actually cash varied between £216 10s. 0d. low and £223 high.

Trading in the copper ring was brisk and the turnover unusually high at 17,425 tons. Finally, the close was £220 for cash and £220 5s. 0d. three months, cash being up £2 and three months £1. Business with consumers was not very good, the fact being that they look for lower prices in spite of the production cuts. Doubtless, in due course something will turn up to check the fall, but for the present it seems as though the downward drift will continue for some time to come. An active tin market produced a turnover for the week of nearly 1,000 tons, the close being £1 up for cash at £781 10s. 0d. and 10s. better for three months at £785 10s. 0d. Warehouse stocks were up by 277 tons to 9,987 tons. On a turnover of 6,350 tons, lead closed 10s. lower for both positions at £64 cash and £65 5s. 0d. three months. In zinc, about 5,125 tons changed hands, cash being 7s. 6d. down at £79 2s. 6d., and three months 10s. up at £78 17s. 6d.

Birmingham

A significant feature of the industrial situation in the Midlands area is that the unemployment rate, at 1·9 per cent, is now above the national average for the first time since the war. The unemployment total has reached 41,923, but the Ministry of Labour say that a total of 76,000 are working less than a full week. The majority of these are in the motor trade, with most of the remainder also in jobs affected by the car recession. The Midland Regional Board for Industry says that this recession is being felt progressively more keenly by component and accessory firms. On the other hand, the high level of investment in new plant and machinery and the optimistic outlook of the machine tool industry are encouraging. Curiously enough, there is still a shortage of skilled labour in the area, and there are vacancies for more than 36,000.

The most active section of the steel industry is that concerned with structural steel. A considerable amount of building work is taking place in Birmingham and neighbouring towns, and orders for such products as joists, sections and reinforcing bars are sufficient to keep mills fully employed. Orders for steel sheet and strip are declining. There is also less work in the iron foundries, due partly to the slackness in the motor trade, but also through quieter conditions in the light castings business connected with domestic heaters and cookers.

New York

At the week-end, copper futures were firmer on covering and new buying following the advance in London and the announcement of the Anaconda 10 per cent cut in copper production in the U.S. and in Chile. Dealings were active. Physical copper was firmer in the export sector and in dealer domestic copper, but except for some increase in export business, physical copper continued quiet. Some copper sources believe that further output reductions and possibly another decrease in the producer copper price may be necessary to bring copper demand and supply into balance.

Tin was firmer and remained steady and quiet. Lead and zinc were quiet. Scrap copper was unchanged at steady prices and offerings were light.

The General Services Administration has asked Congress for authority to sell almost 4,000 tons of nickel, cobalt and copper bearing metals. At the same time, G.S.A. also announced that it is soliciting proposals for the upgrading of Government owned tungsten concentrates into higher use forms.

Paris

The Paris Chamber of Commerce and Industry predicted a moderate expansion of France's economy for the first half of this year in its monthly economic survey published last week. The moderate industrial progress made in 1960 would continue at a slightly slower rate, probably on an average of 7 per cent higher than last year's first half, the Chamber estimated. Taking into account the general export prospects and orders booked or forecasts made by manufacturers, the Chamber made a percentage forecast of 20 per cent for industrial rises in aluminium activity during the first half of this year compared with the first half of last year, and four to five for the metal processing industries.

France's aluminium production in 1960 totalled 253,200 tons compared with 173,000 tons in 1959, announced Pechiney last week. In addition, the French share in the Cameroon aluminium production by a joint company, "Alucam", totalled last year 39,060 tons of a total output of 43,940 tons. The balance went to Belgian interests. Pechiney said that its own Metropolitan output rose from 144,530 tons in 1959 to 187,300 tons in 1960.

Zurich

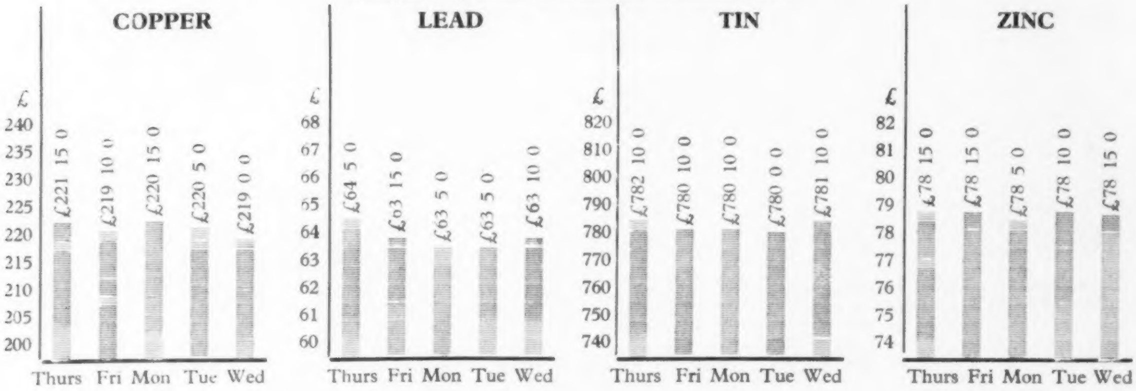
Turnover continued to increase on the Swiss precious metals market during the week to January 18. Trade circles stated that demand for all metals from all groups of users had risen. The revival of industrial buying is attributed to a seasonal increase of current requirements as well as to replenishment of stocks.

The gold price was reduced during the period under review by 20 francs per kilo in accordance with the trend abroad, but this decline had no bearing on the development of industrial demand. The rise in the platinum price was due to a reduction of offerings.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 19 January to Wednesday 25 January 1961



Primary Metals

All prices quoted are those available at 2 p.m. 25/1/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	,,	217	10	0
Antimony Metal 99%..	,,	210	0	0
Antimony Oxide				
Commercial	,,	194	10	0
Antimony White				
Oxide	,,	196	0	0
Arsenic	,,	400	0	0
Bismuth 99·95%......	lb.		16	0
Cadmium 99·9%	,,		11	0
Calcium	,,	2	0	0
Cerium 99%	,,	15	0	0
Chromium	,,		6	11
Cobalt	,,		12	0
Columbite .... per unit			—	
Copper H.C. Electro..	ton	219	0	0
Fire Refined 99·70%	,,	218	0	0
Fire Refined 99·50%	,,	217	0	0

		£	s.	d.
Copper Sulphate	ton	76	0	0
Germanium	grm.		—	
Gold	oz.	12	12	10
Indium	,,		10	0
Iridium	,,	24	0	0
Lanthanum	grm.		15	0
Lead English..........	ton	63	10	0
Magnesium Ingots	lb.			
99·8%	,,		2	2½
99·9+%	,,		2	3
Notched Bar	,,		2	9½
Powder Grade 4......	,,		6	1
Alloy Ingot, AZ91X..			1 11¾-2	1¼
Manganese Metal	ton		—	
Mercury	flask	69	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	,,		5	6
Osmium	oz.		nom.	
Osmiridium	,,		nom.	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	,,	30	5	0
Rhodium	,,	46	0	0
Ruthenium	,,	16	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	7⅝
Tellurium Sticks	lb.	2	0	0
Tin	ton	781	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	,,		—	
Virgin Min 98%	,,	78	13	1½
Dust 95/97%	,,	128	0	0
Dust 98/99%	,,	134	0	0
Granulated 99+% ..	,,	103	13	1½
Granulated 99·99+%	,,	118	13	9

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg≏£/ton		Canada c/lb≏£/ton		France fr/kg≏£/ton		Italy lire/kg≏£/ton		Switzerland fr/kg≏£/ton		United States c/lb≏£/ton	
Aluminium			26.00	215 16	2.43	179 11	370	216 1	2.50	206 5	26.00	207 4
Antimony 99.0					2.30	170 0	495	286 3			29.00	231 2
Cadmium					15.75	1,069 0					150.00	1,195 10
Copper												
Crude												
Wire bars 99.9							420	245 5				
Electrolytic	30.25	223 11	27.50	222 15	3 05	225 7			2.80	231 0	29.00	231 6
Lead			10.00	81 0	.94	69 9	163	95 3	.83	68 9	11.00	87 13
Magnesium												
Nickel			70.00	581 0	9.00	665 2	1,200	699 6	7.50	618 15	74.00	589 15
Tin	109.00	796 13			11.09	819 11	1,480	864 6	9.68	798 12	100.62	801 18
Zinc												
Prime western			12.00	99 12 0								
High grade 99.95			12.60	104 11 0								
High grade 99.99			13.00	107 18 0					1.18	97 7		
Thermic					1.20	88 13						
Electrolytic					1.28	94 13	181	105 14			13.00	104 0

C

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 25/1/61

Aluminium Alloy (Virgin)		£	s.	d.
B.S. 1490 L.M.5	ton	210	0	0
B.S. 1490 L.M.6	,,	202	0	0
B.S. 1490 L.M.7	,,	216	0	0
B.S. 1490 L.M.8	,,	203	0	0
B.S. 1490 L.M.9	,,	203	0	0
B.S. 1490 L.M.10....	,,	221	0	0
B.S. 1490 L.M.11....	,,	215	0	0
B.S. 1490 L.M.12....	,,	223	0	0
B.S. 1490 L.M.13....	,,	216	0	0
B.S. 1490 L.M.14....	,,	224	0	0
B.S. 1490 L.M.15....	,,	210	0	0
B.S. 1490 L.M.16....	,,	206	0	0
B.S. 1490 L.M.18....	,,	203	0	0
B.S. 1490 L.M.22....	,,	210	0	0

Aluminium Alloys (Secondary)		£	s.	d.
B.S. 1490 L.M.1	ton	180	0	0
B.S. 1490 L.M.2	,,	183	0	0
B.S. 1490 L.M.4	,,	193	0	0
B.S. 1490 L.M.6	,,	192	0	0

*Aluminium Bronze		£	s.	d.
BSS 1400 AB.1......	ton	241	0	0
BSS 1400 AB.2......	,,	249	0	0

*Brass		£	s.	d.
BSS 1400-B3 65/35 ..	ton	172	0	0
BSS 249	,,	—		
BSS 1400-B6 85/15 ..	,,	218	0	0

*Gunmetal		£	s.	d.
R.C.H. 3/4% ton	,,	—		
(85/5/5/5) LG2	,,	214	0	0
(86/7/5/2) LG3	,,	224	0	0
(88/10/2/1)	,,	276	0	0
(88/10/2/½)	,,	286	0	0

*Manganese Bronze		£	s.	d.
BSS 1400 HTB1.....	,,	193	0	0
BSS 1400 HTB2.....	,,	208	0	0
BSS 1400 HTB3.....	,,	228	0	0

Nickel Silver		£	s.	d.
Casting Quality 12%	,,	247	0	0
,, ,, 16%	,,	268	0	0
,, ,, 18%	,,	298	0	0

*Phosphor Bronze		£	s.	d.
B.S.1400P.B.1.(A.I.D. released)	,,	304	0	0
B.S. 1400 L.P.B.1	,,	236	0	0

**Average prices for the last week-end.*

Phosphor Copper		£	s.	d.
10%	ton	250	0	0
15%	,,	253	0	0

Phosphor Tin		£	s.	d.
5%	,,	—		

Silicon Bronze		£	s.	d.
BSS 1400-SB1	,,	279	0	0

Solder, soft, BSS 219		£	s.	d.
Grade C Tinmans ...	,,	359	10	0
Grade D Plumbers ..	,,	287	15	0
Grade M	,,	395	5	0

Solder, Brazing, BSS 1845		£	s.	d.
Type 8 (Granulated)	lb.	—		
Type 9 ,,	,,	—		

Zinc Alloys		£	s.	d.
BSS 1004 Alloy A ..	ton	112	3	9
BSS 1004 Alloy B....	,,	116	3	9
Sodium-Zinc	lb.		2	6½

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium					
Sheet 10 S.W.G.	lb.			2	10½
Sheet 18 S.W.G.	,,			3	0½
Sheet 24 S.W.G.	,,			3	3½
Strip 10 S.W.G.	,,			2	10½
Strip 18 S.W.G.	,,			2	11½
Strip 24 S.W.G.	,,			3	1
Circles 22 S.W.G.	,,			3	4½
Circles 18 S.W.G.	,,			3	3½
Circles 12 S.W.G.	,,			3	2½
Plate as rolled	,,			2	10
Sections	,,			3	4
Wire 10 S.W.G.	,,			3	1½
Tubes 1 in o.d. 16 S.W.G.	,,			4	4

Aluminium Alloys			
BS1470. HS19W.			
Sheet 10 S.W.G.	,,	3	3
Sheet 18 S.W.G.	,,	3	5½
Sheet 24 S.W.G.	,,	4	1
Strip 10 S.W.G.	,,	3	3
Strip 18 S.W.G.	,,	3	4½
Strip 24 S.W.G.	,,	4	0½
BS1477. HP30M.			
Plate as rolled	,,	3	1
BS1470. HC15WP.			
Sheet 10 S.W.G.	,,	4	3
Sheet 18 S.W.G.	,,	4	8½
Sheet 24 S.W.G.	,,	5	8½
Strip 10 S.W.G.	,,	4	4
Strip 18 S.W.G.	,,	4	8½
Strip 24 S.W.G.	,,	5	4½
BS1477. HPC15WP.			
Plate heat treated ...	,,	3	10½
BS1475. HG19W.			
Wire 10 S.W.G.	,,	4	2
BS1471. HT19WP.			
Tubes 1 in. o.d. 16 S.W.G.	,,	5	5
BS1476. HE19WP.			
Sections	,,	3	4
Split tube			
19 S.W.G. (½")	,,	4	1
20 S.W.G. (⅜")	,,	3	10
21 S.W.G. (⅜")	,,	4	0
22 S.W.G. (¼")	,,	4	10
Welded tube			
14 to 20 S.W.G. (sizes ½" to 1½")	,,	3/10 to 5/8	

Brass		£	s.	d.
Tubes	lb.		1	9¾
Brazed Tubes	,,		3	0⅛
Drawn Strip Sections	,,		3	0¼
Sheet	ton	190	5	0
Strip	,,	190	5	0
Extruded Bar	lb.		2	0
Condenser Plate (Yellow Metal)............	ton	182	0	0
Condenser Plate (Naval Brass)	,,	194	0	0
Wire	lb.		2	7⅞

Beryllium Copper		£	s.	d.
Strip	,,	1	4	11
Rod	,,	1	1	6
Wire	,,	1	4	9

Copper		£	s.	d.
Tubes	lb.		2	1⅞
Sheet	ton	255	10	0
Strip	,,	255	10	0
H.C. Wire	,,	271	15	0

Cupro Nickel		£	s.	d.
Tubes 70/30	lb.		3	5⅞

Lead		£	s.	d.
Pipes (London)	ton	104	0	0
Sheet (London)	,,	101	15	0
Tellurium Lead	,,	£6 extra		

Nickel Silver		s.	d.
Sheet and Strip 10%..	lb.	3	9¾
Wire 10%	,,	4	2¾

Phosphor Bronze		s.	d.
Wire	,,	4	0⅜

Titanium (1,000 lb. lots)			
Billet 4½" to 18" dia.....	lb.	47/-	48/-
Rod ¼" to 4" dia........	,,	85/-	53/-
Wire ·036"-232" dia....	,,	159/-	99/-
Strip ·001" to ·048"....	,,	350/-	68/-
Sheet 8' × 2'. 20 gauge	,,	73/-	
Tube, representative average gauge	,,	198/-	
Extrusions	,,	90/-	

Zinc		£	s.	d.
Sheet	ton	114	5	0
Strip	,,	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 24/1/61.

Aluminium	£
New Cuttings	139
Old Rolled	110
Segregated Turnings	74

Brass	£
Cuttings	156
Rod Ends	141
Heavy Yellow	129
Light	124
Rolled	143
Collected Scrap	128
Turnings	133

Copper	£
Wire	200
Firebox, cut up	197
Heavy	195
Light	190
Cuttings	202
Turnings	177
Braziery	172

Gunmetal	£
Gear Wheels	190
Admiralty	190
Commercial	176
Turnings	171

Lead	£
Scrap	55

Nickel	£
Cuttings	—
Anodes	555

Phosphor Bronze	£
Scrap	176
Turnings	171

Zinc	£
Remelted	70
Cuttings	60
Old Zinc	38

Financial News

An Acquisition

It has been reported that the Pyrene Company Ltd. has acquired the business of Perfichrome, the electro-plating company, of Brownhills, Staffs. This business, it is understood, is to be operated as a separate division of Pyrene, and will be described as the Perfichrome division.

Winfield Rolling Mills

Ordinary shares of Winfield Rolling Mills Ltd. are, we understand, to be introduced to the Birmingham Stock Exchange.

A Capital Issue

It has been decided by the board of directors of Imperial Chemical Industries Limited to make an issue of new Ordinary Shares of £1 each and to offer these shares at the price of 55s. per share to the Ordinary Stockholders on the company's Register of Members as at the close of business on January 20 last, at the rate of one new Ordinary Share for each £20, or part thereof, of Ordinary Stock held by them. The number of shares to be issued will lie between a minimum of 12,584,450 and a maximum of 12,910,000. Applications for additional shares will not be accepted and no increase in the company's authorized capital is needed for this issue.

The new Ordinary Shares will not participate in the final dividend for the company's financial year ended December 31 last, but will otherwise carry full dividend rights as from January 1 this year, and will rank in all other respects *pari passu* with the existing Ordinary Stock of the company. Application will be made to the Council of The Stock Exchange, London, and to Provincial Stock Exchanges for permission to deal in and for quotations for the new Ordinary Shares which, when fully paid, will be converted into Ordinary Stock, transferable in units of £1 and multiples thereof.

British Oxygen Co. Ltd.

In his statement to shareholders at the annual general meeting of the company, to be held on February 15 next, Mr. J. S. Hutchison, chairman, says: "The group profit of £9,515,941 compares with £8,587,144 after depreciation of £4,747,023 (£4,339,723 last year). The profit increase of £928,797 again came almost entirely from sales expansion overseas; greater turnover in home trading was offset by higher wages and other costs, particularly in the last few months, and profit margins narrowed.

"Net additions to fixed assets at £6,300,000, stock and work in progress at £13,500,000, and capital commitments at £6,900,000 are all higher than last year, because of the substantial additions being made to our production capacity. A year ago our three-year programme of capital expenditure totalled £28,000,000. This total increased rapidly during 1960, mainly because of additional contracts obtained for the supply of process oxygen for steelmaking; it is now over £40,000,000.

"We have transferred £1,350,000 this year from profits to general reserve, bringing it to a total of £8,500,000, and subsidiary companies have retained £1,202,851 of the year's profit. The directors now recommend a final dividend of 10 per cent less tax, making 16 per cent less tax for the year, an increase of 2 per cent on last year."

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Saunderson and Costin (Cemented Carbides) Limited (678838), Andover Road, Highclere, Hants. Registered December 23, 1960. To carry on business of manufacturers of and dealers in tungsten carbide tools, etc. Nominal capital, £10,000 in £1 shares. Permanent directors: Edward J. H. Saunderson, Wm. G. Bishop, John E. D. Scott and Albert E. Barden.

J. T. White (Metal Merchants) Limited (678998), 4 High Street, Spalding, Lincs. Registered December 28, 1960. Nominal capital £1,000 in £1 shares. Directors: Mrs. Phyllis Holroyde and Maurice G. Bellamy.

Trade Publications

Impalco Aluminium. — Imperial Aluminium Company Limited, P.O. Box 216, Witton, Birmingham, 6.

Three new volumes have just been added to this company's literature dealing with Impalco aluminium. The first, containing over 100 pages, deals with aluminium and aluminium alloy extrusions in general including angles, bars, channels, I beams, tees, top hats, zeds, rounds, squares and hexagons. In 36 pages, volume 2 deals with selected extrusions for transport and building purposes, and miscellaneous uses, while the third volume describes the extruded and drawn products of the company, and their many applications.

X-ray Analyser.—The Cambridge Instrument Company Limited, 13 Grosvenor Place, London, S.W.1.

This brochure (list 177/2) gives a comprehensive description of the company's microscan X-ray analyser, which is now in full production. As well as static probe point-by-point quantitative micro-analyses, this instrument can also be used for scanning the surface over an area up to ½ mm × ½ mm. The characteristic X-rays from any single element (with atomic number 12 or greater) can be selected by a crystal spectrometer and detected by a proportional counter.

Industrial Ovens and Furnaces.—A.E.W. Limited, Imperial Works, High Street, Edgware, Middx.

This brochure describes and illustrates a few of this company's standard range of electric furnaces and ovens. Among those described are the ovens suitable for temperatures up to 400°C., flameproof ovens, circular and conveyor ovens. Then there is the A.E.W. patent chamber construction furnaces; the type "H" electric furnace, an important feature of which is the easy and speedy replacement of elements; the type "L" furnace with built-in control panel and pilot lights, temperature regulator, etc., also electric conveyor furnaces, vertical electric muffle furnaces, and soldering iron furnaces.

LIGHT METALS STATISTICS IN JAPAN
(Sept. 1960)

Classification	Production	Shipment	Stock	Export
Alumina	28,178	39,407	10,236	14,450
Super purity Al	192	52	412	0
Primary Al	11,543	10,885	6,218	0
Secondary Al	4,273	4 163	576	0
Wrought products (Al and its alloy)	10,714	11,396	3,182	836
Plate, sheet and strip	7,458	7,872	2,333	692
Foil	739	766	300	8
Rolled and extruded shape	1,481	1,607	194	78
Forgings	43	—	—	—
Electric wire	993	1,151	355	58
Powder, flake and paste	—	—	—	—
Casting	5,446	—	—	—
Sand and permanent mould	3,097	—	—	—
Die	2,349	—	—	—
Sheet products	2,032	2,082	1,907	73
Primary Mg	149	174	25	—
Secondary Mg	243	18[illegible]	366	—
Mg casting	30	—	—	—
Sponge Ti	178	318	973	310
Super purity Al (Sept.)	175	81	105	0
Primary Al (Oct.)	12,153	11,152	7,[illegible]19	0

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

France (new francs per kilo):

Electrolytic copper scrap	(£218.0.0)	2.95
Heavy copper	(£218.0.0)	2.95
No. 1 copper wire	(£206.18.0)	2.80
Brass rod ends	(£160.7.0)	2.17
Zinc castings	(£63.11.0)	0.86
Lead	(£61.6.0)	0.83
Aluminium	(£136.14.0)	1.85

Italy (lire per kilo):

Aluminium soft sheet clippings (new)	(£178.2.0)	305
Lead, soft, first quality	(£79.8.0)	136
Lead, battery plates	(£43.16.0)	75
Copper, first grade	(£207.6.0)	355
Bronze, commercial gunmetal	(£169.1.0)	290
Brass, heavy	(£140.3.0)	240
Brass, light	(£125.11.0)	215
Brass, bar turnings	(£143.1.0)	245
Old zinc	(£57.4.0)	98

Japan (Yen per metric ton):

Electrolytic copper	(£—)	285,000
Copper wire No. 1	(£—)	255,000
Copper wire No. 2	(£—)	236,000
Heavy copper	(£—)	245,000
Light copper	(£—)	205,000
Brass, new cuttings	(£—)	187,000
Red brass scrap	(£—)	223,000

West Germany (D-marks per 100 kilos):

Used copper wire	(£195.1.0)	225
Heavy copper	(£190.14.0)	220
Light copper	(£164.14.0)	190
Heavy brass	(£125.14.0)	145
Light brass	(£86.14.0)	105
Soft lead scrap	(£50.5.0)	58
Zinc scrap	(£47.13.0)	55
Used aluminium unsorted	(£78.1.0)	90

THE STOCK EXCHANGE

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ISSUED CAPITAL *	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 23 JANUARY	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1960-61 HIGH	1960-61 LOW	1959 HIGH	1959 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation	29/-	+2/6	11	9	7 11 9	34/9	25/6	33/3	23/3
400,000	2/-	Anti-Attrition Metal	1/3		NIL	4	NIL	1/6	0/9	1/7½	1/-
41,303,829	Stk. (£1)	Associated Electrical Industries	41/6	—9d.	15	15	7 4 6	67/3	39/3	67/-	54/-
3,236,424	1	Birfield	55/-		15‡	15	2 14 6	61/-	34/0	75/4½	46/-
4,795,000	1	Birmid Industries	72/6	+6d.	20	20D	5 10 3	72/9	56/-	75/6	46/9
5,630,344	Stk. (10/-)	Birmingham Small Arms	43/-	+3/6	17½QT	12½	4 1 6	45/6	27/7½	69/-	36/-
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	14/10½		5	5	6 12 3	17/4½	14/10½	17/6	15/-
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/4½		6	6	6 17 3	20/-	17/1½	20/1½	17/9
500,000	1	Bolton (Thos.) & Sons	40/-	+2/-	10	10	5 0 0	42/3	37/-	47/-	27/6
300,000	1	Ditto Pref. 5%	14/3		5	5	7 0 3	16/-	13/6	16/-	14/9
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6%	17/9	—3d.	6	6	6 15 3	21/1½	17/9	21/6	18/9
18,846,647	Stk. (£1)	British Insulated Callender's Cables	56/6	+1/-	13½	13½	4 15 6	61/-	47/6	61/-	45/1½
17,047,166	5/-	British Oxygen Co. Ltd., Ord.	27/9	+1/6	10	10	1 16 0	34/6	19/6	87/9	49/3
1,200,000	Stk. (5/-)	Canning (W.) & Co	14/-	—3d.	15+8⅙C	25+ *2½C‡	5 7 3	19/6	13/3	18/1½	12/3
60,484	1/-	Carr (Chas.)	1/-		NIL	12½	—	2/3	1/-	2/10½	1/3
555,000	1	Clifford (Chas.) Ltd.	26/6		10	10	7 11 0	35/-	26/-	30/-	22/6
45,000	1	Ditto Cum. Pref. 6%	15/3		6	6	7 17 6	16/-	15/3	16/-	17/-
300,000	2/-	Coley Metals	3/6	—3d.	15	15	8 11 6	5/-	3/3	4/6	2/6
10,185,696	1	Cons. Zinc Corp.†	66/6	+1/-	20	15	6 0 3	80/-	60/6	77/3	57/9
5,399,056	1	Davy-Ashmore	139/-	+6/-	30‡	20	2 3 3	146/3	100/6	116/-	43/-
7,695,000	5/-	Delta Metal	20/-	—3d.	17½	31‡	4 7 6	28/-	18/7½	26/4½	11/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	49/-		15	15	6 5 0	56/3	45/-	61/9	36/7½
1,155,000	1	Evered & Co.	43/6		10B	10 ϕ	3 1 3	42/9	29/-	42/6	30/-
18,000,000	Stk. (£1)	General Electric Co.	31/9	—3d.	10	10	6 6 0	47/6	29/3	50/6	30/-
1,500,000	Stk. (10/-)	General Refractories Ltd	45/-	+1/6	20	20	4 9 0	51/6	40/-	47/-	31/4½
750,000	5/-	Glacier Metal Co. Ltd	14/6		13	11½	4 9 9	15/9	11/1½	11/3	6/7½
2,500,000	5/-	Glynwed Tubes	24/-	—1½d.	25¶	20	3 13 0	27/1½	17/7½	30/9	16/1½
7,228,065	10/-	Goodlass Wall & Lead Industries	37/6	+1/-	19L	16	3 16 0	41/6	33/4½	53/-	28/7½
696,780	10/-	Greenwood & Batley	25/-xcap	—6d.	30W	30	5 15 6	133/9	112/6	130/-	75/-
792,000	5/-	Harrison (B'ham) Ord.	12/7½	1½d.	*20‡	*17½	3 19 3	15/4½	11/9	26/9	14/-
150,000	1	Ditto Cum. Pref. 7%	20/3		7	7	6 18 3	20/-	19/3	19/6	19/4½
1,075,167	5/-	Heenan Group	11/6	+3d.	13D	15	4 18 6P	12/6	10/-	19/6	7/4½
249,932,548	Stk. (£1)	Imperial Chemical Industries	70/-	+4/9	11½N	8	3 4 3	75/3	54/-	62/7½	33/1½
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	15/1½	—4½d.	5	5	6 12 3	17/9	15/3	19/1½	15/6
22,184,044	**	International Nickel	113	+5	$1.60	$1.50	2 10 6	113	85½	201½	154½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	14/-		5	5	7 2 9	16/6	14/6	17/6	14/9
6,000,000	1	Ditto Ord.	62/6	+3/-	12D	12	2 11 0	66/6	45/-	50/3	27/3
600,000	10/-	Keith, Blackman	19/-	+3d.	17½	17½E	9 4 3	32/6	17/9	32/-	25/-
320,000	4/-	London Aluminium	8/10½		12	10	5 8 3	12/6	7/6	10/7½	5/3
765,012	1	McKechnie Bros. Ord.	57/-		17½F	15F	6 2 9	71/6	57/-	62/6	39/9
1,530,024	1	Ditto A Ord.	54/-		17½F	15F	6 9 0	69/3	55/-	65/6	38/9
1,108,268	5/-	Manganese Bronze & Brass	14/6		20⅝	20⅝	7 3 6	18/9	13/4½	19/-	13/6
50,628	6/-	Ditto (7½% N.C. Pref.)	6/-		7½	7½	7 10 0	6/6	6/-	7/9	5/9
21,745,110	Stk. (£1)	Metal Box	75/-	+1/6	12M	13B	2 15 3	83/-	55/9	80/-	44/7½
415,760	Stk. (2/-)	Metal Traders	7/-	—3d.	50	50	14 5 9	10/4½	7/1½	13/6	8/4½
160,000	1	Mint (The) Birmingham	36/6	—6d.	10	10	5 9 6	39/-	33/6	35/-	22/-
80,000	5	Ditto Pref. 6%	76/3		6	6	7 17 6	80/-	75/-	80/-	69/-
5,187,938	Stk. (£1)	Morgan Crucible A.	54/-		13	12	4 16 3	62/3	47/6	52/6	30/-
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref.	16/9		5½	5½	6 13 3	18/6	15/9	19/3	17/3
3,850,000	Stk. (£1)	Murex	43/-	+1/6	22½J	15	5 19 6	45/-	35/3	76/4½	41/-
585,000	5/-	Ratcliffs (Great Bridge) Ord.	16/6		10	10R	3 1 6	17/-	14/9	—	
195,000	5/-	Ditto 8% Max. Ord.	5/-		8	—	8 0 0	5/3	5/-	—	
1,064,880	10/-	Sanderson Kayser	34/3		35‡	25	5 2 3	40/3	27/7½	56/-	27/9
3,400,500	Stk. (5/-)	Serck	15/9	+3d.	12½	17½GD	3 19 6	25/-	15/3	26/-	12/-
7,232,069	Stk. (£1)	Stone-Platt Industries	56/3	+6d.	15	15	5 6 9	64/3	52/3	63/6	42/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	15/6		5½	5½	6 17 6	18/7½	15/3	18/9	15/10½
33,989,712	Stk. (£1)	Tube Investments Ord.	73/9	—3d.	14	20	3 15 9	95/9	66/3	138/-	71/7½
41,000,000	Stk. (£1)	Vickers	28/9	—3d.	10	10	6 19 3	39/-	27/3	40/6	26/10½
750,000	Stk. (£1)	Ditto Pref. 5%	14/-		5	5	7 2 9	17/6	14/-	17/3	14/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	20/-		*5	*5	7 8 9A	24/3	20/-	25/9	20/6
4,594,418	1	Ward (Thos. W.) Ord.	64/6	—1/-	25‡	20	3 17 6	86/-	64/-	167/6	83/-
7,109,424	Stk. (£1)	Westinghouse Brake	38/3	—3/3	11	10	6 0 0	59/9	37/9	60/7½	39/-
225,000	2/-	Wolverhampton Die-Casting	9/6	+6d.	35	30	7 7 3	13/10½	8/3	13/1½	8/8½
591,000	5/-	Wolverhampton Metal	28/3	+2/9	32½	27½	5 15 0	39/6	23/9	34/3	21/6
156,930	2/6	Wright, Bindley & Gell	3/9		15	20‡	9 13 6	4/3	2/10½	4/3	2/6
124,140	1	Ditto Cum. Pref. 6%	13/3		6	6	8 17 9	15/3	13/3	14/3	12/10½
150,000	1/-	Zinc Alloy Rust Proof	4/10½		40	30	8 4 1	5/6	4/-	3/10½	2/9

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% capitalized issue. ◦The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. ϕ and 6¼% from Capital Profits B and 50% capitalized issue. G and 1⅞d. special distribution. F and special 5% tax free dividend. H As forecast. ¶And 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. N Interim since increased. J and 75% capitalized issue. S and 40% capitalized issue. O calculated at 13⅞%. Interim on smaller capital. P Calculated at 11½%. Q also 1/- special tax free dividend and proposed 50% capitalized issue. T Per £1 unit. W Before capital reorganization. Calculated at 15%.

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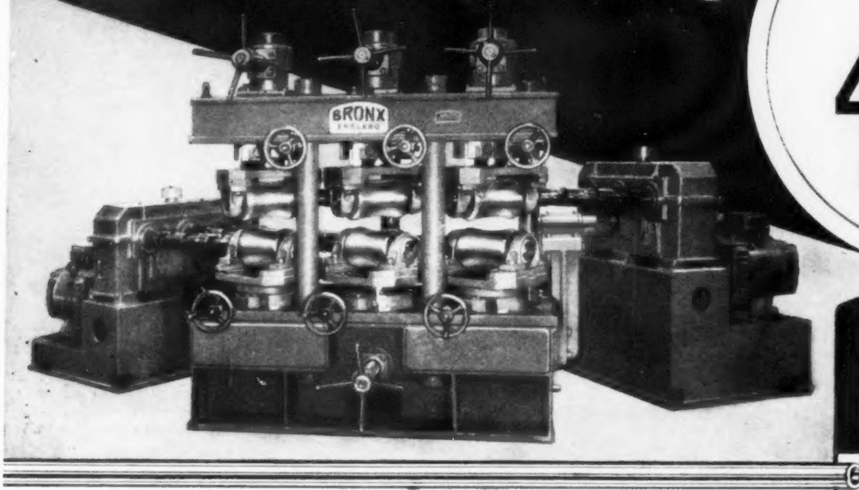

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CONTENTS

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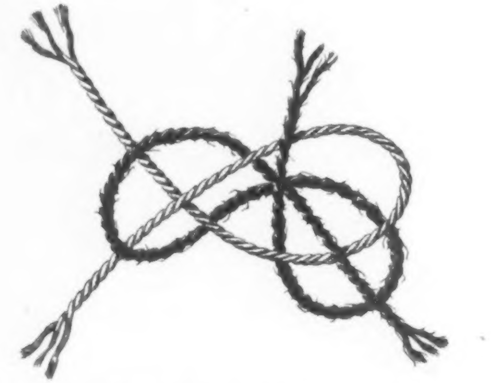

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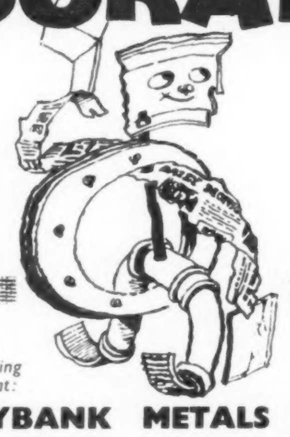

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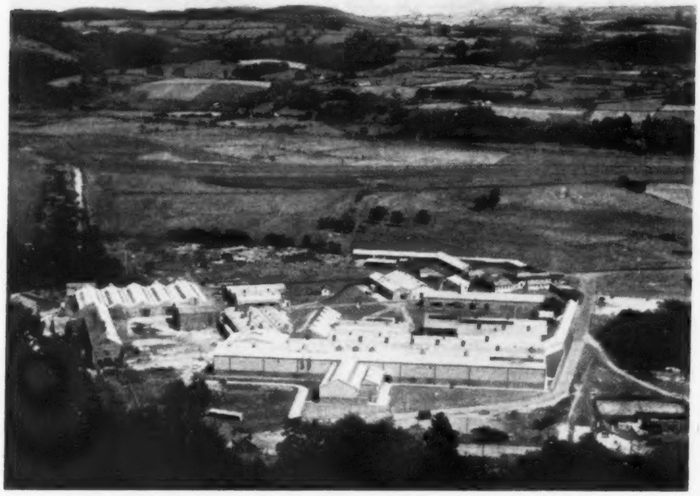

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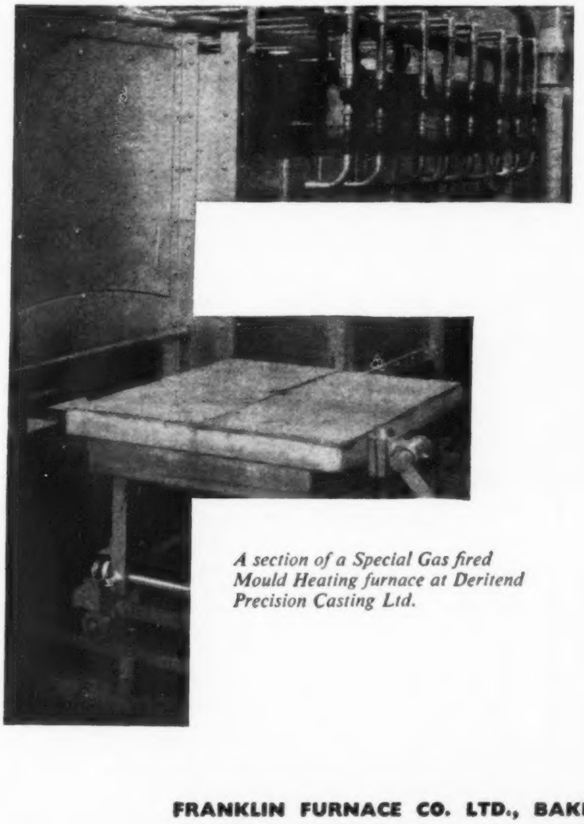

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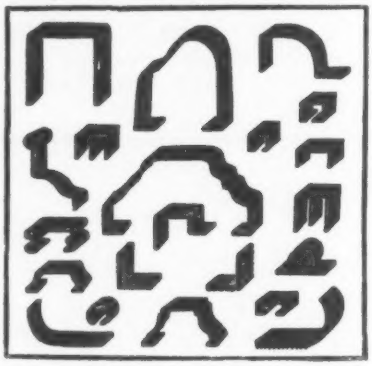

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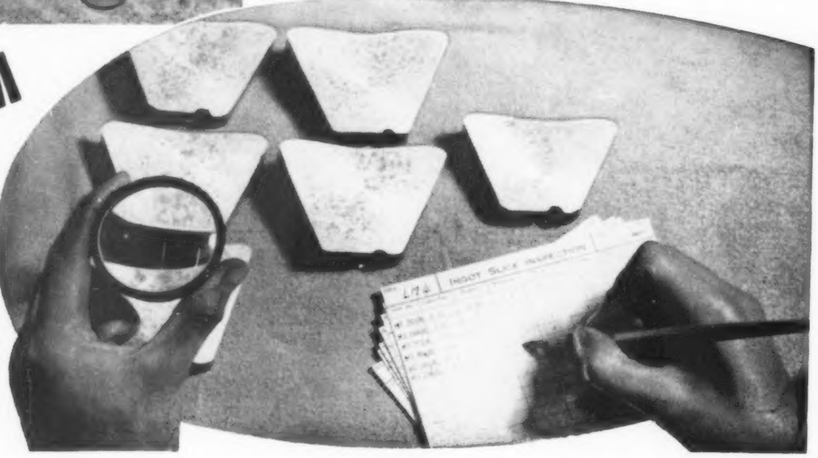

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